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EDITORIAL NOTES.

Retort-House Women.

THE article published in our columns last week, describing the experiences in the operation by women of three retort-houses at the Vauxhall station of the South Metropolitan Gas Company, has considerably enlarged interest in the subject of the dilution of labour in gas-works. The actual work that is being, and has been for some time, done by women in the Vauxhall retort-houses is a negation of all the old-rooted beliefs as to such duties being beyond the physical capacity of women. The point needs emphasizing. That the demonstration of the capacity of women to engage in this work, without any ill-effects, should have occurred in the South of England is an advantage; for the last place in the country in which we should have expected to have had attested the fitness of women (without any selection in respect of former occupation) for such work is in a works down South, where, generally speaking, the women are not of the same hardy type as their sisters away up North. As was particularly mentioned last week, the women in the Vauxhall retort-houses are, for the most part, quite slim and short, and not the equals physically of women who have been brought up to heavier work farther North. Yet the record shows that temperatures have had no ill-effects on them, and that their general health has been improved by the occupational change.

However, Vauxhall proves—recollect the machinery is of the Arrol-Foulis type, and has been in use for a considerable period—that women, providing they are locally available, can perform the work in all retort-houses machine operated. Vauxhall is a large works; and therefore what is done there can be equally well accomplished in smaller or medium-sized works. The three retort-houses at Vauxhall are quite independent the one of the other; and thus any one of them may be taken as representative of the carbonizing capacity of a number of gas-works in the country. Then on the score of size, nothing can be advanced against the stage-floor functions in machine-worked houses being performed by women. The South Metropolitan Company have done pioneer work in this connection, and have subverted old notions in doing so; and there are no doubt many gas engineers who will now, for their own protection and the assurance of the continuity of gas supply next winter, desire to emulate the Vauxhall success.

And not only medium-sized works. There are the small works with direct-fired and scoop or hand charged retorts. Some of these works at the bottom of the scale in regard to size have been severely hit in the matter of man power; and many a manager has, when there has been a push in demand this winter, had to divest himself of his coat, and give a hand at charging and discharging. Both in the national and local interests, it is to be hoped that, where men of military age are employed, trial with women will be made in both scoop and shovel charged retort-houses; and we shall be pleased enough to describe the results of the experiences in works of any size. Where there is tackle in use for handling scoops and rakes, there should be no more difficulty in training women for the work than in machine-stoked houses. Perhaps rather more stalwart women would be required for hand-scoop work. But, as in shovel-charging, knack in handling scoops goes a long way. As to retort-houses that are shovel-charged, these to-day are, as a rule, of relatively small size; and therefore do not demand any long continuous strain. We should not be disinclined, after what was seen at Vauxhall, to try the ability of suitable women even at shovel-charging, and should begin their training by putting them upon oxide and coke shovelling work. The coke women at Vauxhall can with ease throw to the right or left hand just as desired by circumstances; and the purifier women on piece work spurned the light shovels that were provided for them, and wanted, and obtained, the heavier shovels that were formerly used by the men. There is a dead-weight about oxide; but the Vauxhall women have developed a remarkable dexterity in handling it. Therefore, there seems little reason to question that women could be trained to shovel-charge retorts. We admit that this is the most difficult work of all; but our old beliefs as to the employment of women in retort-houses at all have been falsified by events, and that they cannot be trained to hand-charge retorts may also be completely declared by experience to be a fallacy. Gas engineers will recall the case of the little Irish Gas-Works at Magherafelt where, until a few years ago, Miss Ina G. Richmond was the manageress and did most things on the works, including the hand-stoking. She proved it could be done.

Remember next winter! The difficulties of the present winter should alone serve as a sufficient stimulus to a reconsideration of the question of the dilution of gas-works labour; and the anticipation of the enhanced difficulties of next winter should serve as the final inducement to every responsible gas man—whether in charge of large, medium, or small gas-works—to resolve to carry dilution, where fit men of military age are employed, into the retort-house, as has been done at Vauxhall. Change cannot be made while output is at full tide. But the spring and summer are the best training periods for women for this work; and as demands for gas grow with the autumn and the winter, so will the skill and efficiency of the women in their work.

Gas Light and Coke Company's Increased Income Counterbalances Extra Expenditure.

THE report and accounts of the Gas Light and Coke Company under the new order of annual issue are to hand; and, this being the first communication from the Directors to the proprietors for a year as to the position of the Company, the proprietors will probably be making investigation of them with greater interest than when they received information every six months. During the year they have seen announcements of increases in the price of gas, have been paid an interim dividend at the rate per annum of £3 14s. 8d. p.ct., less income-tax, and are now uncertain—even if the Directors get through Parliament the enabling Bill which they have promoted—whether they will obtain an increased dividend for the current half year. Judging from the present accounts, we should imagine the Board have, in making the last increase in price, included in their estimates an improvement in the dividend; but the conditions attaching to the expenses of running the gas business in these times are so unreliable that there will assuredly be a little wonder on the point outside the Board-room. The dividend which will be paid in respect of the past half year will be at the same rate as the interim one; but the proprietors will observe that—despite the increase in the price of gas, the larger gas sales, the extraordinary yield from residuals, the advance in rentals for meters, stoves, &c.—the balance to be carried forward into the current year is about £100,000 less than the sum that was brought into the 1917 accounts from the previous year, when a dividend at the rate of £4 4s. was paid.

However, the proprietors must not look upon the year's accounts in too gloomy a spirit. If they open the revenue account, they will find the debtor side clouded with accre-

tions of expenditure, but faced by a credit page disclosing a magnificent inflow of revenue in every item. Taking the revenue account alone, it will be remarked that the estimates of the Directors for the year were laid with a fine-cut exactitude; for while the total income amounted to £7,029,550, which was an increase upon 1916 of £977,184, the total expenditure amounted to £6,000,370, or £978,932 more than the previous year; so that, less only by £1748, the additional income equalled the extra outgoings, which is, to say the least, in view of the considerable increased outlay of the year, a fortunate circumstance.

Examining the items, coal and wages are the two that have absorbed the greater part of the increased costs of working. This will have been anticipated even by those not intimately concerned with the administration of gas undertakings. Coal cost £2,967,775, which is no less than £685,896 more than in 1916; and the wages bill totalled to the huge sum of £1,524,536, which is a heavy advance upon 1916—in figures £262,624. The employees of the Company will see from this that they have had their full share of the revenue. The increase in the coal bill is partly due to the sales of gas having advanced by 6 p.ct., to obviously inferior coal now being supplied (for the make is down to 11,971 c.ft. per ton, as compared with 12,733 c.ft. in the June half of 1916, and 12,644 c.ft. in the December half), and, therefore, more coal having to be used, and to the increased cost of transport. In their report the Directors very naturally "regret" to announce that during the year they have lost several valuable steamers, which they have only been able to replace to a limited extent, which means paying market rates for tonnage to make up the deficiency. Not one of these causes affecting the cost of coal is of a nature over which the Board can exercise any control. The actual quantity of coal used was 2,100,625 tons, or more by 309,459 tons than in 1916. But the coal gas made was 2,419,763,000 c.ft. in excess of the previous year. The total gas made was 31,480,511,000 c.ft., of which 25,147,528,000 c.ft. were coal gas, and 6,332,983,000 c.ft. water gas. The total make in 1916 was 29,247,656,000 c.ft., of which 22,727,765,000 c.ft. were coal gas, and 6,519,891,000 c.ft. water gas. In the making of the water gas last year 9,126,311 gallons of oil were used (or 1·44 gallons per 1000 c.ft.), which was a reduction upon 1916 of 4,112,856 gallons, although last year only 186,908,000 c.ft. less water gas were made, which tells a tale of high cost of oil, and economical use. As a matter of fact, the smaller quantity of oil cost £318,895, or £47,298 more than in 1916. The coke used for manufacturing water gas is charged at £186,315, which is £51,097 more. These several figures mean that the total cost of materials for manufacturing gas was £3,472,985, or more than in 1916 by £784,291.

But fortunately secondary products lent a friendly helping hand—yielding £1,997,059, or more by £398,267. Deducting the bye-products income from the total paid for manufacturing materials, a net cost of £1,475,926 is arrived at, compared with £1,089,902 in 1916, or an advance of £386,024. The additional income of £398,267 from secondary products was made up by £354,198 from coke, £35,589 from tar and tar products, and £26,453 from sulphate of ammonia, with a deduction to be made for a decline of £17,975 in the receipts from breeze. But, including the other manufacturing expenses (without deducting the income from the bye-products), the total costs under the heading came to £4,563,725, or more by £964,490—notable items, other than manufacturing materials, being an increase of £83,894 in wages (total £317,237) and £91,025 in repair and maintenance of works (total £707,266). It may be surmised, in view of the difficulties with materials and labour, that the Board are in the last-named item making provision for the time when they are released from the restrictions of the present to execute work that, in ordinary circumstances, would have been carried out, although it is noticed that the Directors append to the report the customary statement that the engineers at the several stations have furnished certificates that all the works and plant have been maintained in thorough efficiency. Turning aside for the moment from the revenue account, it is observed that the capital expenditure for the year was £267,680, of which no less than £195,052 was for buildings and machinery, and extensions of works. However, the additional expenditure has not augmented the capital account, seeing that no less than £393,527 has been written off for depreciation. So the net result is that capital is £125,847 to the good. Reverting to the revenue account, disbursements under distribution total to £789,722, or £31,272 more than in 1916. There are no other particularly noticeable items of expenditure, except that "co-partnership" is a disappearing one, being only £2439 for the year. But against this, have to be set the large increase in wages of upwards of a quarter of a million, and the increase from £15,608 to £17,829 in the allowance to employees on active service.

To the brighter side. We have already spoken of the contribution of the secondary products to the increase of revenue. Gas, in yielding £4,474,812, gave £541,377 more—partly due to the 6 p.ct. increase in consumption, and for the rest to the advance in price. Only £3000 odd was the addition from the public lighting; so that the remainder was contributed entirely by the private consumers. The total sale of gas reached the excellent figure of £28,372,855,000 c.ft., or 1,574,934,000 c.ft. in excess of 1916, all of which, except an extra 24,670,000 c.ft taken for public lighting, was required by private customers. The proprietors will be interested in learning that the consumption of gas last year, being 28,372,855,000 c.ft., was greater than in 1913—the last complete pre-war year, when the sale amounted to 27,157,933,000 c.ft. With regard to the stability of this gratifying increase in business, no one can, of course, order favourable atmospheric conditions for stimulating consumption. But the facts that the rental of meters increased by £3343 to £159,267, the rental of stoves by £13,306 to £179,816, and the rental of fittings by £19,200 to £203,430, and that the Directors are able to report an increase of 3869 in the number of consumers, and of 43,372 in the number of gas-stoves sold and let on hire, are all pledges of security. They, with the technical and other commercial developments of the gas industry are worth considerable regard in respect of permanency, as a set-off to the temporary burdens which have had such heavy effect upon the conditions and fortunes of the industry.

Coke Accumulations—Cause and Remedies.

COKE is accumulating at an alarming rate at most gas-works both in and about the Metropolis and in the Provinces, and this in the winter time just when, with conditions in regard to transport what they are, there should be clear coke-yards and a local demand exceeding the supply. The cause for this condition is not far to seek; and it is no use evading it, for such a course will not bring relief. So long as the cause exists, stocks of coke will continue to accumulate, unless the Coal Controller comes to the aid of gas undertakings. Upon him the gas industry has some claim in this matter; for he is the only power in the land that could have dealt, and can now deal, with the real cause of coke accumulation, and he is the only power that can effectually so order things that the existing stocks can be dispersed, and fresh accumulation be prevented, to the advantage not only of gas undertakings, but of traffic now and next winter.

The Coal Controller is cognizant of the huge existing and still growing stocks of coke; and just recently he made some move of a welcome but not very effectual character with the object of assisting in their disposal. Gas undertakings in the metropolitan area were informed that the time for the supplies of coke irrespective of the allowances under requisitions was extended from Jan. 7 to Jan. 31; and they were given liberty to sell, and consumers to buy, for delivery before Feb. 1, up to 5 tons outside the regular allowances. This is all right so far as it goes; but it does not go far enough. Nor does it remove the main cause of the decline in the demand for coke, which cause operates as much under this extension of liberty as it did before it was made. The cause is the deteriorated quality of the coke, combined with the high price that must be charged for it in view of the heavy cost of coal, which cost varies according to the geographical position of the gas undertaking, and the means that have to be adopted to obtain delivery of the coal upon the works. These are the conditions contributing to accumulation. The poor quality of the coke is due wholly to the fact that the coal itself, through want of cleansing at the pits, contains such a large proportion of deleterious matter, which affects the physical character of the coke and its heating power. Inasmuch as refuse-laden coal so substantially affects the quantity of material to be transported by rail or ship, is wasteful of trucks and tonnage, and has scattered, and is still scattering, uneconomy throughout the country, it is a matter for the Coal Controller to deal with. Also the fact that this inferior quality of coal (which might have been avoided by compelling a reasonable cleansing) is

at the bottom of the accumulation of coke and its continued accumulation, makes it a matter for the Coal Controller to take the necessary measures for the dispersion of the stocks, and for the prevention of their repetition.

Gas undertakings cannot compel householders or manufacturers to buy coke. They could perhaps dispose of the stocks by marketing them at a disastrously low price. But the only way in which the situation can be effectually dealt with is by the Coal Controller compelling the use of coke as a substitute for coal, and to let its sale be unrestricted. There is every reason for this course. Though compulsion could not perhaps be imposed in midwinter, the immediate months following could be utilized in ensuring the purchase and storage of coke by fuel consumers, and the traffic conditions of next winter be greatly relieved. Last year householders and fuel-using industries were counselled by the Controller to stock their cellars and stores with coal during the summer months, with the view to relieving during the following winter the railways and labour engaged in its distribution. Such a plan could be improved on this year by compelling those who desire to protect themselves in regard to fuel supply next winter by timely storage, to buy coke instead of coal, and to utilize the ships, trucks, and labour saved by this course in supplying in the light period all industries—such as the gas industry—in which coal is an absolute essential. It is the only way out of the difficulty of accumulating stocks of coke, which is distributed fuel lying idle, and yet hampering the gas undertakings with increasing severity. We believe it is not improbable that the Coal Controller will issue some directions that will inure to the compulsory use of coke. If this belief is well-founded, then the sooner it materializes the better.

But the gas industry wants Mr. Calthrop to also remove the cause of the inferior quality of coke, which deprives it of so much market value. The arguments for the effective cleansing of coal have been advanced time and again. The case for so doing is an unanswerable one. So far as coke is concerned, the amount produced would, if the material supplied was all good coal and gas producing, result in a smaller make of coke in relation to the gas output, while the poor quality coke, which comparatively few people seem to want, is increased in output through the inferior quality of the coal. The Coal Controller has been bombarded with complaints as to the condition of coal supplies; and now, if we are correctly informed, there is some hope of an improvement shortly in the situation as a result of his investigations into the question of washing and screening. If there is not an improvement, uneconomy will continue, and that is a thing which the country not only does not want, but cannot afford in these times. What it has already lost through the distribution of dirty coal is something incalculable. Upon the Coal Controller in this matter rests an immense responsibility.

Gas Charges Based on the Price of Coal.

IN electricity supply, it is becoming quite a common thing for power contracts to have a clause in them providing for a variation of charges according to the price of coal; but there has been little precedent for anything of the kind in connection with gas supply—for the reason that, though coal is an important item in the price of gas, taken alone it is a very unsafe one on which to base authority for altering the price of gas. In the first place, the difficulty presents itself of gas undertakings making changes in the quality of the coal they buy. In the case of a better class coal being purchased in normal times, up would go the price per ton, which, though the producing power of the coal would be enhanced, might *primâ facie* be taken to justify an increase in the price of gas, though not actually so. On the other hand, the purchase of a lower quality coal might reduce the price paid per ton; and the gas consumer might, though the producing power of the coal was less, take this to entitle him to a reduction in the price of gas. Coal quality would therefore be a disturbing factor. And coal is not by any means the only factor subject to change that affects producing costs. This will be the case more in the future than in the past; for no one can exactly gauge to-day the prospective actual cost of new capital, labour, and materials and goods of all descriptions.

The only concern engaging in the supply of town gas that we can at the moment recall that has had experience of the price of coal as the basis for the charge for gas is the Alliance and Dublin Consumers' Gas Company. The arrangement, however, was only a temporary one, being part of the settlement with the Corporation in connection with the Company's Act of 1909. The standard price of gas was then fixed at 3s. 7d.; and it was agreed that for three years the price charged should be regulated by the cost of coal, in this way: The then charge of 3s. 4d. was not to be exceeded so long as the average price of coal was 13s. 6d. per ton c.i.f. But for every 1s. that the average price of coal rose above 13s. 6d., an extra charge of 1d. per 1000 c.ft. of gas was allowed; while for every 1s. that the average price of coal fell below 13s. 6d., the charge was to be reduced by 1d. In the South Staffordshire Mond Gas Act of 1901, the Company were authorized to charge a price not exceeding 3d. per 1000 c.ft. if the quantity taken was not less than 4 million c.ft. per quarter, and not exceeding 4d. per 1000 if the quantity taken was less. But if at any time it was proved to the satisfaction of the Board of Trade that the price of good quality slack exceeded 6s. per ton delivered at the Company's works, then the Board might by order authorize an increase in the price of gas by $\frac{1}{8}$d. per 1000 c.ft. for every 1s. by which the price of slack per ton exceeded 6s. per ton when delivered at the Company's works, or by such other proportionate amount as the Board determined. Some doubts were raised whether under these provisions the Board, in considering the question of increasing the price of gas, would regard any matter other than the gross cost of fuel. By the Act promoted by the Company last year, it is seen that they were not satisfied with having their claims to an increase in the price of gas adjudicated upon with fuel only as the factor for consideration; and so, in asking that the above-mentioned prices of 3d. and 4d. should be altered respectively to 5$\frac{1}{2}$d. and 6$\frac{1}{2}$d., the powers of revision to the Board of Trade should, it was enacted, be based upon the "cost of production," which, of course, would have regard to all factors. The importance of this change is obvious.

Among the proposals affecting the sliding-scale of price and dividend to be laid before Parliament in the forthcoming session, that which is being made by the Garw and Ogmore Gas Company has the distinction of being the only one that introduces coal as a factor to be considered. The Company are proceeding by way of Provisional Order, and the point will come before the Board of Trade; and we hope it will not be rejected, without due consideration, in favour of some other course being taken. The proposal is that in any half year in which the average price paid by the Company per ton of coal delivered at their siding does not exceed 15s., the standard price shall be 4s. 6d. per 1000 c.ft. In any half year in which the average price per ton exceeds 15s., it is contemplated that the standard price of gas may be raised 6d. per 1000 c.ft. in respect of every 2s., or any part thereof, by which the price per ton of coal exceeds the 15s. We do not know why 6d. is the amount decided upon; but, without discussing it before it has been considered by the Board of Trade, it is apparent that it has been adopted to cover more than the additional price of coal, which is a necessary precaution in these days when labour, materials, goods, and in fact all outgoings, are so heavy and uncertain compared with pre-war times.

The same cannot be said of the sliding-scale based on the price of coal adopted by some of the French Gas Companies as a war-time expedient. According to this scale, the equivalent of an increase of 2$\frac{3}{4}$d. per 1000 c.ft. is allowed for a rise of 2s. 6d. in the price of coal. With a make of 11,000 c.ft. of gas per ton, there is no margin in the 2$\frac{3}{4}$d. per 1000 c.ft. for anything else besides coal; and the costs of French gas companies in all directions have been adversely affected as have ours in this country. However, the consumers have little of which to complain in regard to the 2$\frac{3}{4}$d. in respect of two-and-sixpenny increases in coal cost alone, though there may be several 2$\frac{3}{4}$d. to add to the price of gas. In a paragraph that appeared in the "JOURNAL" for Jan. 15 (p. 108), some sample war prices of gas charged in France were given—ranging from 5s. up to 15s. 10d., 16s. 10d., and 18s. per 1000 c.ft. The conditions there are altogether different from those operating in this country. We look on the circumstances at home as severe. They are worse in France. Most of the coal is sent from this country. Regulated prices are higher for the coal itself; and freight, controlled though it be, carries the cost of coal to a figure that is altogether unreasonable for gas making. Every difficulty in regard to labour and other necessaries in France is accentuated as compared with this country. The gas consumers have to pay these heavy prices for gas. There is no help for it. In Germany also the prices that are being charged for gas are much higher than in this country. At home, too, the charges for electricity have in many cases gone up by

40 and 50 p.ct. It has cut against the grain of gas men here to put up prices to the figures that they have already gone to; but fleshless dividends are changing their views. Whatever be the circumstances, the proper price of gas is one that includes all the factors contributing to the cost of production—not omitting a fair return upon the capital employed in rendering the service.

The Sulphate of Ammonia Market.

At this time of the year, readers of the "JOURNAL" have been accustomed to see quoted from at length, and to study with interest, the annual review of Messrs. Bradbury and Hirsch, of Liverpool, of the course of the sulphate of ammonia market; but on the present occasion this pleasure is, by force of circumstances, to be denied them. As is well known, the market has been under the control of the Government since January of last year; and prices have been fixed to meet various political and military considerations. Thus supply and demand have not governed the market, nor will they do so while war conditions continue; and this being so, Messrs. Bradbury and Hirsch felt that any statistics which they could have collected would have been valueless as a guide to those interested in the sulphate of ammonia trade. They therefore decided not to write a review of the year 1917.

Flueless Gas-Radiators.

Regarding the discussion that has recently taken place in our columns on the subject of flueless gas-radiators, the full reports by Mr. J. H. Coste and Dr. Hurtley have been forwarded to us by Dr. Waldo, Coroner for the City and Southwark; and these are published in our "Miscellaneous News" to-day. We take it that Dr. Waldo has sent the text of the reports as a counterstroke to the criticism; but this does not dispose of the criticism, nor does it advance the matter in any way. The several current topics which demand editorial notice this week preclude immediate further comment; but an opportunity will no doubt offer for a few additional reflections upon the reports.

Benzol Recovery

The benzol-recovery process is one in which, without attention to detail, efficiency can be much impaired, and a considerable amount of benzol in the aggregate can be lost. This is the lesson of the excellent paper that Messrs. B. Wilson Haigh and Harold Lamb read before the Midland Section of the Coke-Oven Managers' Association last Saturday. It is true the work that has so far been done in this connection has not greatly extended our knowledge of the conditions that are most favourable to the production of benzol and its homologues; and we are afraid complete knowledge will not be quickly gained unless benzol producers themselves take some steps to institute and finance thorough research in manner that cannot be expected from the chemical members of staffs who have their daily routine tests to perform, and have very little leisure time for exploration outside them, other than perhaps of an intermittent nature. The degree of the preheating of the benzolized oil, the ideal temperature at which to aim when the oil leaves the still, the percentage of water that will interfere with the efficiency of the debenzolized oil as an absorbing medium, the proper stripping of the oil in the still so as to avoid loss in scrubbing, the comparative temperatures of the scrubbing oil and gas, are all important questions for determination. But there is also much research to be carried beyond, into physico-chemical conditions the results of which will guide in practical working. Actual operation of a benzol-recovery process is not a difficult matter; but it is a process which demands care over details, and therefore strict supervision is all-important.

And Rectification.

Like remarks apply equally to benzol rectification; and, in this regard, the ability to accurately determine the composition of the crude benzol is a point for consideration. The retort test—its limitations and shortcomings—has provoked much criticism. But the authors' investigations show that it is reliable if carefully carried out under uniform conditions, and the proper corrections applied to thermometer readings. But it fails to show in what respect a particular benzol is abnormal, and it gives little insight into the relative proportions of benzene, toluene, and xylene in a sample. The authors therefore suggest the wisdom of the general adoption of the flask test as supplementary to the retort test. In connection with rectification plants, another problem, with varying qualities of crude benzol to treat, has been the expression of working results in a manner to render them comparative. It will be seen that the authors set themselves the task of finding some satisfactory method of doing this. Within the limits of their research, they have enabled a comparison to be made between various benzols, and have also rendered possible the calculation of equivalence of low-grade benzol to the normal 65 p.ct. strength produced by the same plant. The work, however, requires to be extended by the testing on similar lines of ranges of samples from other works.

The Legality of Free Meters.

In the "Correspondence" columns of the "JOURNAL" for Jan. 1, "Fairplay All-Round" asked the question whether gas undertakings are legally entitled to supply meters free of charge? No one has answered the inquiry; and so perhaps we may venture to express an opinion. If any one has any other view, then our correspondent and ourselves will be pleased to hear it. It is evident that "Fairplay All-Round" is under the impression that legally meters ought not to be supplied free of rent because there is no express sanction for so doing in the Gas-Works Clauses Act, 1871 (sections 13 to 18). But, on the other hand, there is nothing in any of these clauses that expressly forbids gas undertakings from supplying meters free of charge The whole of the clauses confer permissive powers, and are not obligatory, in regard to the supply of meters, the charging of rent, and the making of terms as to repair, &c. Every consumer of gas "shall, if required to do so," consume gas by meter. Provision is made, "if required," for security in respect of the meter; and, in regard to hire, "the undertakers *may* let for hire"—there is nothing which says they shall charge hire. As we say, the whole of the clauses, so far as gas undertakings are concerned, are permissive and not obligatory. From the point of view of equity as between consumers and consumers, we believe in a meter-hire charge, and proportionate to the sizes and capital and maintenance expenses attaching to meters. Our correspondent gives an illustration showing how inequitably a non-meter hire policy works out on the basis of varying gas consumption.

The Motor Gas Restriction Order.

The new gas restriction order is not being taken lying-down by commercial motor-car users. In previous references to the subject in these columns, the view has been expressed that it would be a deplorable thing to make restriction so stringent that the road transport of the country, already deficient, would be materially interfered with. To the extent that gas can be spared for the purpose, it should be utilized to effect improvement in road transport for commercial purposes, so supplementing the permissible petrol rationing. It will be remembered that one of the definite intentions of the new order is to refuse a gas permit and a petrol licence for one and the same vehicle. The Commercial Motor Users' Association fear that the effect of this will be not to decrease, but to increase, the amount of petrol used; and a deputation to the Public Control Department of the Board of Trade has pointed this out. The contention is that many commercial motor owners have gone to the trouble and expense of converting their vehicles to use coal gas, so as to take the utmost advantage of their motor transport; and they only utilize the small quantity of petrol allowed when it is not possible to refill the gas-containers, and when negotiating hills where the use of gas is unsatisfactory. They, therefore, urge that a more liberal allowance of petrol than that permitted in the order should be granted to users of coal gas, so that transport efficiency should be kept at as high a level as possible. The authorities have promised to reconsider the matter. In doing so, they might take into account the points that all gas-works are not so hard-pressed as others in respect of the demands on their output resources; and that in not a few weeks now the curve of the gas demand will be showing a downward sweep, which will be continuous if not interrupted by severe weather. Last week the change in temperature made a considerable difference to demand compared with the previous fortnight, when many degrees of frost were registered; and every week now makes some change in lighting-up time.

The Past Year's Coal Exports.

The tale of the coal, coke, and manufactured fuel exports has been completed by the issue of the December returns. During the month 2,379,595 tons were shipped, which was a reduction of 402,422 tons on the corresponding month of 1916, and of 1,090,641 tons on December, 1915. The value of the exports last month was £3,411,276 (£1 8s. 6d. per ton), compared with £3,530,760 in December, 1916 (£1 5s. 6d. per ton), and £3,158,503 for the same month of 1915. In the whole year, 37,800,705 tons were shipped, or a diminution of 3,357,041 tons on 1916, and of 7,969,639 tons on 1915. The value, however, last year was no less than £51,341,487, which was an increase of £670,883 on 1916, and of £12,517,264 on 1915, in both of which years considerably less coal, &c., was sent abroad. In 1913 the country experienced its largest export of coal—73,400,118 tons. To make the figures correspond, to this should be added 1,235,141 tons of coke, and 2,053,187 tons of manufactured fuel. From these figures it will be seen that the total coal, coke, and manufactured fuel exported last year was just about one-half the quantity in 1913; nevertheless the value was little short of the 1913 figure—£51,341,487, compared with £53,700,000 for the coal, coke, and manufactnred fuel shipped in 1913.

Coal Available for Home Consumption.

In connection with the returns, the "Iron and Coal Trades Review" calculates that the quantity of coal available for home use has not diminished. It says that "despite the decrease in production (which last year must have been about 37 million tons less than in 1913), the reduction in the foreign shipments has enabled us to find a larger quantity than ever for home consumption—that quantity being over 201¼ million tons in 1916, or about 4½ tons per head of the population, whereas the quantity so available in 1913 was only 189 million tons, or about 4 tons per head. Last year the position was probably much the same, for, although there was a further reduction in exports, the output decreased." But if the 201¼ million tons contained (say) an extra 10 p.ct. of inert material, this would mean an additional 20 million tons of wasteful material distributed about the country, and nearly 4 million tons in the coal exported, tonnage for which had to be found which might better have been devoted to the importation of foodstuffs. It is often overlooked that coal is by a long way the greatest tonnage of any single article with which this country has to deal; and therefore in these times the greater the need for excluding useless material.

British Industries and Education.

The support of over two thousand firms of all sizes, and engaged in all kinds of work throughout the country, is stated to have been given to a report which has been drawn up by a Committee of the Federation of British Industries on proposals put forward by the President of the Board of Education for the reform of the national system. Answers to questions sent out show that practically the whole of these firms approve of the suggestion of the Committee that all children should receive a compulsory education up to the age of fourteen, and that this age should not be extended until sufficient teachers and facilities can be provided to enable this to be done efficiently, and until the labour market has adjusted itself to the new conditions. A similarly favourable reception was accorded to the Committee's suggestion that, at about the age of twelve, the more promising children should pass to a secondary school or a junior technical school, leaving the less promising pupils in the elementary school. The idea is that this division of the second period of elementary education into two classes should be based either upon success or failure in attaining a fairly high standard by examination, or upon an analysis of the child's work and its results during the previous years, or by a combination of both these methods; and that as regards the time of joining the secondary or junior technical schools considerable elasticity should be allowed. Full opportunities should also be given to children on leaving school at fourteen to continue their education at voluntary continuation classes. Methods of carrying out such a scheme of education are set forth in the report. The Committee are not in agreement with the proposal of Mr. Herbert Fisher (the President of the Board of Education) to impose compulsory part-time education at the present time on all children in this country up to the age of eighteen. From the answers which have been received to their questions, it is, they say, evident that in every industry this proposal is viewed with great alarm, as the establishment of the new system would occur at the very time when it would be most essential for the industrial future of the country that the minimum of dislocation should take place. But, while saying this, the Committee feel that they are in general accord with Mr. Fisher's views on secondary education; and they are entirely sympathetic to the principle that "every child in the country, of whatever class, should have an opportunity of complete education, if it is fitted to benefit by it."

Coke-Ovens and Coal Mines Control.

The Coal Mines Control Bill only awaits Royal Assent to entitle it to place in the Statute Book. Now control in regard to finance is to become an actuality; but there are doubts in some directions as to the measure realizing all that was anticipated by the Coal Controller and the Coal Mining Association who collaborated with him in drafting the working agreement. However, time alone (not speculation) can disclose the effect of its operation. There is confidence in many quarters; a lack of it in others. The greatest heartburning took place among coalowners representing some 100 million tons production over the fact that they are to be deprived of three parts of the 20 p.ct. excess profits allowed to other industries; but the remainder of the owners do not feel any particular anguish over resigning the additional 15 p.ct. Their pre-war dividends are assured, and 5 p.ct. of any excess profits is to be theirs; and the excellent pre-war prices of coal for home use carry with them 6s. 6d. per ton to cover increased war expenses, and 9s. in the case of Wales. As the Bill now stands, too, exemption from the agreement is specifically made in respect of coke-ovens and bye-product plants belonging to the owners of coal mines, and "of any distinct and independent trade or industry which is not ancillary to the colliery portion of the undertaking, the books relating whereto were in the standard period kept, and can in the period of control be kept, in such a manner that the capital invested and the profits earned in respect of such distinct and independent trade or industry can be readily ascertained."

PERSONAL.

Among the recent appointments to the Order of the British Empire is that of Mr. ERNEST E. CUTLER, a Director of Messrs. Samuel Cutler & Sons, Ltd., whose works at Millwall have been engaged upon war work of a special character since the very commencement of hostilities.

Two employees of the Stafford Corporation Gas and Electricity Department—Corporal J. HOLMES, R.E., and Private W. ROWLEY, R.A.M.C.—have distinguished themselves by brave conduct on the battlefield. The former has received the Military Medal, and the latter has been recommended for it. At a concert presided over by Mr. W. M. Valon (the Engineer and Manager of the gas-works), and attended by the Mayor of Stafford and members of the Corporation, a gold watch was presented by the Committee, through Councillor Barton (the Vice-Chairman), to Corporal Holmes; and the employees gave him a gold chain. A wristlet watch is to be given to every soldier from the department.

OBITUARY.

Gunner JOHN WILFRED TRAVIS, of the Royal Field Artillery, whose instantaneous death in action occurred on the 12th inst., was, before enlistment, on the clerical staff of the Ilkley District Council Gas-Works. He was 21 years of age.

Mr. JOHN C. FULTON, J.P., the Secretary of the Portadown Gas Company, who passed away last week, had held the chairmanship of the Urban District Council for some years, and was re-elected to that position a few hours before his death.

The death occurred last week, at the age of 57, of Mr. W. H. BANKS, of Bolton Percy, Yorks., and formerly of Pudsey. He was Chairman of the Pudsey Gas Company, and a Director of other gas companies, up to the time of his death. The funeral was at Pudsey, and was attended by the Mayor and other public men, and representatives of the Pudsey Gas Company, the Crosshills, Halton, and Seacroft Gas Company, and the Calverley and Horsforth Gas Company.

New Secretary of the Gas Light and Coke Company.

The Directors of the Gas Light and Coke Company have appointed Mr. William Lyle Galbraith to be Secretary, in succession to the late Mr. W. Beckford Long. Mr. Galbraith, who is of Scottish origin, is a barrister-at-law. His father was a civil engineer—a member of the firm of Galbraith and Church.

GAS LIGHT AND COKE COMPANY.

Annual Report and Accounts.

THE following is the report of the Directors of the Gas Light and Coke Company for the year ended Dec. 31, which, with the accounts [some figures from which are given below], will be presented at the ordinary general meeting on Friday, Feb. 8.

The accounts for the year show that, after the payment of a dividend of £3 14s. 8d. p.ct. per annum for the June half year, and after providing for fixed charges, there is a total available balance of £555,291, out of which the Directors recommend the payment of a dividend on the ordinary stock for the December half year at the rate of £3 14s. 8d. p.ct. per annum, which will absorb £304,247 and leave £251,044 to be carried forward to the credit of the current year. [This is the first occasion on which the accounts have been presented for the period of a complete year, and is in accordance with the Company's Act of 1917.]

The sales of gas for the year show an increase of 6 p.ct. compared with the quantity sold during 1916. There has been an increase during the year of 3869 in the number of consumers, and of 43,372 in the number of gas-stoves sold and let on hire.

The Directors report the retirement, owing to ill-health, of Mr. J. Douglas Walker, K.C., who had been a Director of the Company since 1906. He was a valued colleague; and the Directors very much regret the cause which led to his retirement. They have appointed to the vacancy on the Board Mr. R. M. Holland-Martin, C.B. The Directors also much regret to record the sudden death of Mr. W. Beckford Long, who, after 26 years' service, was appointed Secretary of the Company so short a time ago as October, 1916. He was a most promising officer, and is greatly missed by the Directors and all his colleagues.

The Directors regret that they have had to raise the price of gas on two occasions since the last report was presented to the shareholders. These increases automatically bring about a decrease in the rate of dividend payable on the ordinary stock.

The cost of coal, oil, freights, labour, and materials of all kinds has enormously increased, and accounts for the rise in the price of gas.

The Directors regret to announce that during the past year they have lost several valuable steamers, which they have only been able to replace to a limited extent.

The Bill which was deposited in Parliament with reference to the purchase of ships and other matters received the Royal Assent in due course.

A Bill has been deposited in Parliament *with* the object of amending the statutory provisions which apply to the sliding-scale of dividends, and of obtaining powers with regard to the issue of capital. An extraordinary meeting of the proprietors will be held immediately after the ordinary general meeting on Friday, the 8th prox., when the provisions of the Bill will be explained, and, in compliance with the Standing Orders of Parliament, the Bill will be submitted for the approval of the proprietors.

The number of the Company's employees who have left to serve with the Colours is nearly 4500, of whom a considerable number have been awarded distinctions, mentioned in despatches, or have obtained Commissions. The Directors deeply deplore the increase in the number of casualties among these gallant sailors and soldiers.

The Court of Directors has been furnished by the several Engineers of the Manufacturing and Distributing Departments with certificates that all the Company's works and plant have been maintained in thorough efficiency.

JOHN MILES, *Governor.*

Horseferry Road, Westminster, S.W.1., Jan. 21, 1918.

The Accounts.

The accounts consist of the usual statements.

The statement of capital (stock) sets forth that the total paid-up is £10,413,480; added on conversion, £12,832,955—total amount authorized, £23,246,435. Deducting the amount redeemed, £285,225, the total amount of the Company's existing capital powers is £22,961,210. The statement of loan capital stands thus: Total paid up, £3,186,660; added on conversion, £1,618,190; unissued, £750,000—total amount authorized, £5,554,850.

The capital account shows receipts (with premiums, £1,688,958) to the amount of £29,469,473. The expenditure is shown in the following items:

Expenditure to Dec. 31, 1916			£14,905,741 19 2
Expenditure during the year to Dec. 31, 1917—viz.:			
Buildings and machinery in extension of works	£195,052 16 0		
New and additional mains and service-pipes	6,440 6 7		
Do. do. meters	11,237 18 8		
Do. do. stoves	54,949 6 9		
		267,680 8 0	
		£15,173,422 7 2	
By amount written off plant	£250,807 15 0		
„ mains thrown out of use	12,429 16 0		
„ depreciation of meters and stoves	130,290 0 0		
		393,527 11 0	
Total expenditure		£14,779,894 16 2	
Nominal amount added on conversion		14,451,145 0 0	
		£29,231,039 16 2	
Deduct amount of capital redeemed under Company's Act of 1903		285,225 0 0	
		£28,945,814 16 2	
Balance of capital account		509,202 18 6	
		£29,455,017 14 8	

The total of the net revenue account is £1,380,688; and the balance applicable to dividend on the ordinary stock is £555,291. The following account shows how it is proposed to appropriate it:

Year, 1916.			
£699,091 ..	Balance of net revenue account		£555,291 16 5
	Amount required for dividend for the half year to Dec. 31, 1917		
5,000 ..	Contribution to redemption fund		
(£4 4s. p. ct.)	Dividend on the ordinary stock—		
342,582 ..	£3 14s. 8d. p.ct. per annum on £16,298,975	304,247 10 8	
£351,509 ..	Balance carried to next half-year's account	£251,044 5 9	

The three statements relating to the reserve, special purposes, and depreciation funds stood as follows on Dec. 31: Reserve fund, £80,501; special purposes fund, £341,917; depreciation fund, £87,819.

The following is the revenue account:

Expenditure.

Year, 1916.		£ s. d.	£ s. d.
	Manufacture of gas—		
£2,281,879	Coal, including all expenses thereon	2,967,775 17 1	
271,597	Oil „ less value of oil tar	318,895 14 1	
135,218	Coke, &c., used in the manufacture of carburetted water gas	186,315 15 5	
33,227	Salaries of engineers and other officers at works	32,672 13 3	
233,343	Wages	317,237 18 4	
27,730	Purification	33,551 15 .	
616,241	Repair and maintenance of works and plant, materials and labour, less received for old materials, £14,022 1s. 1d.	707, 66 0 9	
	Distribution of gas—		4,563,725 14
133,644	Salaries and wages of officers (including rental clerks)	146,910 1 1	
218,797	Repair and maintenance of mains and service-pipes, &c.	218,331 2 8	
192,5 3	Repair and renewal of meters	180,209 5 7	
218,898	„ „ stoves	200,546 3 2	
25,870	Fitting up automatic meter supplies	12,423 15 8	
			758,450 18 2
54,633	Public lamps—lighting and repairing	..	61,552 15 6
	Rents, rates, and taxes—		
14,881	Rents payable	15,176 18 0	
336,025	Rates and taxes	364,582 3 0	
			377,759 1 0
	Management—		
7,500	Directors' allowance	7,500 0 0	
604	Company's Auditors and Assistant	604 4 0	
19 331	Salaries of Secretary, Accountant, and clerks	19,933 17 8	
62,144	Collectors and cashiers	77,555 12 5	
13,743	Stationery and printing	11,585 9 8	
13,732	General charges	16,246 10 8	
			133,425 14 5
9,247	Co-partnership	..	2,439 17 7
629	Parliamentary charges	..	600 0 0
966	Law charges	..	5,607 7 11
20	Charges *re* Quinquennial revaluations	..	..
10,934	Bad debts	..	8,275 5 5
1.000	Depreciation fund for works on leasehold lands	..	1,000 0 0
53,984	Annuities to officers and workmen, including contribution to officers' superannuation fund	..	53,052 7 4
15,608	Allowances to employees on active service	..	17,829 17 6
5,610	Workmen's compensation	..	4,708 10 10
8,322	Company's Contribution under National Insurance Act, 1911	..	8,852 5 8
	Public officers—		
2,105	Gas Referees and Official Auditor	2,105 9 0	
1,160	Public testing-stations	984 8 3	
			3,090 7 3
5,021,438			6,000,370 2 7
1,030,928	Balance carried to net revenue account		1,029,.80 1 7
6,052,366			7,029,550 4 2

Total Wages Paid, 1917 £1,524 536 7 11 Total Salaries Paid 1917. £204,314 13 5
19 6 £1,261,012 13 0 1916. £195,016 11 10

Revenue.

Year, 1916.		£ s. d.	£ s. d.
	Sale of gas—		
£3,838,426	Per meter at 3s., 3s. 4d., 2s. 8d., and 3s. 1d. per 1000 cubic feet	4,376,380 10 9	
95,009	Public lighting and under contracts	98,433 11 4	
3,933,435			4,474,814 2 1
155,924	Rental of meters	..	157,267 14 4
166,510	Rental of stoves	..	179,816 12 1
184,230	Rental of fittings	..	203,430 3 11
	Residual products—		
941,660	Coke, less labour, &c.	1,295,858 14 11	
57,453	Breeze, less „ „	39,478 3 9	
312,373	Tar and tar products	347,962 15 8	
287,306	Ammoniacal liquor and sulphate of ammonia	313,759 13 9	
1,598,792			1,997,059 8 1
13,013	Rents receivable		14,672 13 8
462	Transfer fees		489 10 0
6,052,366			7,029,550 4 2

Statement of Coal.

—	In Store Dec. 31, 1916.	Received During Year.	Carbonized During Year.	Used During Year.	In Store Dec. 31, 1917.
	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	268,023	2,080,380	2,100,625*	6172	241,606

* In addition to this quantity of coal, 9,126,311 gallons of oil have been used during the year.

Statement of Gas Made, Sold, &c.

	Quantity Made.	Quantity Sold.	
		Public Lights and Under Contracts (Estimated).	Private Lights (per Meter).
	Thousands.	Thousands.	Thousands.
Gas	† 31,480,511	514,371	27,858,484
Year 1916 . .	29,247,656	489,701	26,308,220

† Including 6,332,983,000 c.ft. of carburetted, &c., water gas.

Statement of Residual Products.

Description.	In Store, Dec. 31, 1916.	Made During Year.	Used During Year.	Sold During Year.	In Store Dec. 31, 1917.
Coke—tons	24,092	1,267,461	240,800	989,506	61,247
Breeze—tons	34,156	316,827	45,552	200,806	104,625
Tar, from coal only—galls.	2,309,696	20,139,067	20,809,930	..	1,638,833
Ammoniacal liquor—butts	35,841	561,441	565,540	..	31,742

The remaining statement is the balance-sheet, which gives the value of the stores on hand at the close of the year as follows: Coal, £369,204; gas oil, £131,687; coke, £76,866; tar and ammoniacal liquor and products, £121,856; and sundries, £489,784. The figures this time last year were: Coal, £339,496; gas oil, £141,963; coke, £21,920; tar, ammoniacal liquor, and products, £135,892; sundries, £480,421.

Visit to the Dalmarnock Gas-Works.

On Saturday afternoon, about seventy members of the Scottish Junior Gas Association (Western District) visited the Dalmarnock Gas-Works of the Glasgow Corporation. Mr. Frazer (the Station Manager), Mr. James Jamieson (late of Dalmarnock and now of Dunfermline), Mr. William White, and Mr. David Mackintosh acted as guides. Great interest was taken in the Glasgow system of vertical retorts, designed by Mr. Alex. Wilson, the General Manager of the Department. There are four benches, each containing forty retorts; the number of retorts set in each bed being ten. The total of 160 retorts have a producing capacity of 5 million c.ft. per day. The coal and coke handling plant is on the telpher system. After the inspection of the gas-works, the members were taken to the chemical-works (which also belong to the Corporation), and were shown the sulphate plant, tar-stills, &c. They were then entertained at tea in one of the buildings of the works. Mr. Frazer welcomed the Association to Dalmarnock; the President (Mr. Alex. Wright, of Lockerbie) and Mr. David Marwick (the Vice-President) responded. Mr. Alex. Wilson tendered an apology from Bailie Drummond (the Convener of the Gas Committee), who had intended being present.

Manchester and District Junior Gas Association.—Members of the Association will visit the Ormskirk Gas-Works next Saturday afternoon; and, at the conclusion of tea (as the guests of the Chairman and Directors of the Ormskirk Gas and Electricity Company), Mr. W. Fletcher will read a paper on "Naphthalene," and Mr. J. W. Thornley some "Notes on Distribution."

British Association of Chemists.—The forthcoming meeting of the London Section of the Society of Chemical Industry (which will take place next Monday evening at the Royal Society of Arts, Adelphi) has been arranged as a meeting of London chemists, held under the auspices of the section, to consider and discuss the proposed formation of a British Association of Chemists, to which reference has already been made in the pages of the "JOURNAL." Any chemists who are not members of the Society will be welcomed at the meeting.

Town Gas Preferable to Producer Gas for Annealing.—An illustrated description of one of three annealing furnaces at the works of the Columbian Annealing and Stamping Company, of Terre Haute (Ind.), is published in the American "Gas Industry." They are of the tunnel pattern (the goods being carried in at one end and out at the other by a continuous traveller), and were formerly heated by producer gas. The output from each furnace was 360 pieces per hour, with six men employed. As the producer gas left the surface of the goods in a condition very favourable to rusting, each piece had to be protected by dipping in acid before passing through the furnace. These difficulties disappeared with the substitution of town gas; and at the same time the output per furnace was increased more than threefold, and the attendant labour reduced to three men. The preliminary pickling was also dispensed with, as with town gas a coating is formed that tends to resist rust, resulting in a saving of 6s. 3d. per day for acid. The two large furnaces each consume 1100 c.ft., and the small one 600 c.ft., of gas per hour. Though the firm only commenced the use of gas two years ago, they now also apply it for the heat treatment of steel for soldering, brazing, and preliminary heating to set off expansion under acetylene welding.

METROPOLITAN GAS REFEREES.

Notification for 1918.

IT may be recalled that a year ago the Metropolitan Gas Referees intimated that (beyond the correction of a single figure) they had no alteration to make in their 1916 Notification, which therefore remained in force. For the present year, however, considerable modifications have been made; and the new 1918 Notification was issued a few days ago. The changes, too, are not confined to the instructions; for there has been a change among the Referees themselves during the past twelve months—Mr. W. J. A. Butterfield having succeeded Mr. A. Vernon Harcourt. The other two Referees are Prof. C. V. Boys and Dr. J. S. Haldane.

One of the results of the changes that have been made is to render the instructions more easily adaptable to the requirements of country places, so many of which have now to follow the Metropolitan Gas Referees' instructions. Originally, the instructions were written for tests made every day; and to meet cases in which they are carried out (say) once in three weeks, some modifications were, of course, necessary. These alterations have, however, been made without introducing anything at all inconsistent with the London working. At first glance, one notices that the new Notification is less bulky than the previous one—occupying 31 foolscap pages, as compared with 44 pages. In other words, there are extensive omissions; a number of appendices and illustrations having been left out—presumably to save reprinting, under present conditions, descriptive matter which was substantially the same in several previous issues.

In connection with washing-out service-pipes to testing-places, to the sentence, "No testing for illuminating power or calorific power is to be made until after the lapse of an hour since the last washing-out," there has been added, "and during this time the gas examiner shall allow gas to pass through the service-pipe to some burner or burners at a rate which he shall judge to be not less than 10 c.ft. per hour."

As to the measurement of gas, it is added that: "The volume of a given quantity of gas is subject to variation according to the temperature and pressure at which it is measured. While the volume of dry gas is subject to variation from both these causes, the gas supplied to a testing-place is moist, and in passing through a wet meter is saturated at the temperature of the meter; and this introduces a more complicated law of variation. In order that a measured volume of gas, as shown by the meter, may have a definite meaning, it is necessary to apply a correction to the observed volume, so as to counteract the effects of the causes of variation referred to above, and thus obtain a figure which represents the volume which the gas would have if it were measured under standard conditions—*i.e.*, at 60° Fahr., 30 in. of pressure as measured by a mercurial barometer, and saturated with water vapour at this temperature and pressure." A table gives figures which represent the volumes of gas saturated with water vapour in such varied conditions of temperature and pressure as are likely to be met with in a testing-place, and another table the logarithms of these figures—the quantity of gas being such that in standard conditions of temperature and pressure its volume is unity. At the head of the first table is the formula from which these tables of gas volumes and their logarithms have been calculated. The aerorthometer gives readings which are the same as the figures in the first table; and this instrument "may be used where preferred," if verified once a month as prescribed.

The meters used for measuring the gas consumed in making the various testings "shall be wet meters charged with water free from glycerine or other admixture." At least once in every year, each meter thermometer is to be compared with a calorimeter thermometer, "or other standard thermometer;" and if the discrepancy is more than half a degree Fahr., "the necessary correction is to be applied" [instead of "the meter thermometer is to be replaced by a new one"]. The meters used for measuring the gas consumed in making the various testings shall, at least once in seven days "on which testings have been made," be proved; and "the meter used shall also be proved immediately, whenever the gas measured by it shows a deficiency of illuminating or calorific power." In the matter of the governors, "the gas before it reaches the meters used in the various testings shall be made to pass through a governor situated within the testing-place, and so loaded as to prevent the water-gauge pressure of the gas exceeding 3 in.;" and "as the operation of the meter gives rise to slight fluctuations in the water-gauge pressure of the gas at the meter-outlet, which would interfere with testing for illuminating and calorific power, a balance-governor shall be provided for the meters used in these testings, to counteract the fluctuations."

In the instructions for testing for illuminating power, it is stipulated, in regard to the pentane lamp, that the residue of pentane in the saturator shall, at least once "in each thirty days on which testings have been made" [instead of "calendar month"], be removed. In testing, the mean of the four readings of the photometric scale shall be multiplied by the number of seconds in the time recorded and by the "gas volume," as shown in the table [instead of "aerorthometer reading"], and divided by 120. The quotient is the illuminating power. "This calculation may be simplified by the use of logarithms," as in an example given. If [omitting "owing to the supply at the present time of illuminating

gas containing a large proportion of enriched water gas, and consequently of greater density"] the burner will not pass sufficient gas to give a light of 8 candles, the gas examiner is to take the rate of consumption which with the burner at the near end of the slide has failed to give equality, and from these data and the "gas volume" [instead of "aerorthometer reading"] to calculate as usual the corresponding illuminating power.

When testing for sulphuretted hydrogen, it is now stipulated, with reference to the lead paper, that "each slip of paper shall be about one square inch in area;" and in the mode of testing for sulphur compounds other than sulphuretted hydrogen, various modifications have been made. As soon as the testing has been started, "the barometer and the meter thermometer are to be read and recorded" [in place of "a first reading of the aerorthometer is to be made and recorded, and a second reading as near as may be to the time at which the gas is shut off"]. Later, the difference between the first and second weighings of the crucible will give the weight of barium sulphate. Multiply this number "by 2·29*n*, and by the gas volume" (see table); the result is the weight of sulphur in 100 c.ft. of gas. An example is given. This replaces the former approximate way of doing the calculation and correction. The paragraph about aerorthometer reading which formerly followed does not now appear; but instead of it is the reference already quoted, under the heading of "Measurement of Gas."

In testing the calorific power of gas, the heating or calorific power of any sample of gas is represented by the number of units of heat produced by the combustion of 1 c.ft. of such gas measured at 60° Fahr., under a pressure of 30 in. of mercury, "and saturated with water vapour." It is remarked that, since, however, when water vapour escapes uncondensed "and hot" the uncondensable products of combustion also pass away at a high temperature, and since the loss of heat thus arising is commonly the greater of the two, the customary partial correction from gross to net has not much significance. In order to test the gas for calorific power, the gas shall first pass through a meter and a "balance-governor" [instead of an "efficient governor," and omitting, "This may be a balance-governor, or a diaphragm governor of a pattern approved by the Gas Referees"]. The measuring vessel shall be placed in position in the sink, and "the change-over funnel adjusted" so that the outlet-water is led into the sink. The mean of four readings of the inlet temperature is to be subtracted from the mean of fifteen readings of the outlet temperature; and the difference is to be multiplied by 11·904, by the number of litres of water collected, and [omitting "the product is to be divided by the tabular number"] "by the gas volume" (see table). "The logarithm of 11·904 (= 3 × 3·968) is printed" in the Notification.

In the previous issue it was stated that "to facilitate these operations, the logarithm of 3 × 3·968 is printed. The logarithms of the reciprocals of the tabular numbers are tabulated. This logarithm may be found therefore in the table directly from the meter-thermometer and barometer readings; and the addition of this to the other logarithms will have the effect of dividing by the tabular number."

With regard to the "gas volumes" table referred to several times in the above quotations, it is probable that the change made to the reciprocals of the former tabular numbers is because of the greater convenience of multiplication over division, especially when logarithms are used—most or all of the calculations in which the former tabular numbers were used necessitating division by them. At the same time, it may be remarked that, for operations not covered by the Notification, the old tabular numbers may sometimes prove more convenient than the new tables of gas volumes. The table of "logarithms of gas volumes" corresponds with the second table of Appendix G of the previous Notifications, with a few minor corrections, presumably due to a slight alteration in the formula used, and with the addition of certain columns, to save interpolation for odd degrees in the most-used portion of the table.

As mentioned at the beginning of this article, a number of appendices have on the present occasion been omitted from the Notification; and there are consequential alterations to those that remain. In the one dealing with the Boys gas-calorimeter, there are also several modifications. It is stated that the thermometers used in the testings must bear a distinctive number which will be recorded on a certificate, "with corrections if necessary," issued by the Gas Referees; and no thermometer shall be used in the testings which has not been certified by them. "These certified thermometers will be re-examined by the Gas Referees from time to time." A caution is added that, "On no account must the water connection of the calorimeter be reversed, causing a flow of water in the opposite direction; as in that case the effluent gases may escape hot and steaming, and an incorrect result be obtained." In the description of the Gas Referees' one-twelfth of a cubic foot measure, it is stated that the apparatus shall only be used in proving a meter when the temperature of the meter and of the water in the water-vessel have been found not to differ by more than "6°" [in place of "2°"] Fahr.; "and if the difference is more than 1°, the necessary correction for the change of volume shall be made by aid of the tables of gas volumes." This presumably is to give rather greater freedom in the employment of the measure in rooms varying in temperature, without reducing the accuracy of its use. When a twelfth of a cubic foot of gas is discharged through the meter, the three-way stopcock is turned so as to fill the instrument with gas, the water-vessel is placed upon the lower shelf, the gas is reduced to atmospheric pressure as before, and a second, a third, "and again a fourth quantity is discharged through the meter." Should the hand attached to the axle of the measuring drum have gained in the "last" three revolutions as much as one division, some water must be removed from the meter; if the meter-hand has lost as much as one division, some water must be poured in. There is an example showing how the correction for temperature may be made with sufficient accuracy when proving the meter.

GAS BILLS FOR 1918.

[FIFTH ARTICLE.]

THROUGH a copy not being at hand, the Bill of the Alliance and Dublin Consumers' Gas Company was not noticed in its proper position. We repair the omission now, before proceeding with the review of the Bills in alphabetical sequence.

The preamble of the Dublin Bill states that the issued capital consists of £1,551,868 of consolidated ordinary stock, and that the sum of £374,000 of debenture stock has been created and issued. The standard price is 3s. 7d.; and the consolidated ordinary stock is entitled to a dividend of 5 p.ct. per annum, subject to an increase or reduction by 1s. 3d. p.ct. in respect of any half year for penny variations in the charge for gas. The price levied in the inner area in the half year ended June 30, 1914, was 3s. 6d., which made the authorized rate of dividend on the consolidated ordinary stock £5 2s. 6d. per cent. per annum. By exercising care and economy in the management, the Company were able to avoid increasing the price of 3s. 6d. until the quarter ending June 30, 1917; but the increase since necessitated reduces the dividend to £4 7s. 6d. p.ct. The Company therefore propose that the dividend payable upon the consolidated ordinary stock in respect of the half year ending on June 30, 1918, and any subsequent half year during any part of which the price per 1000 c.ft. within the inner area has exceeded 3s. 6d., shall be at such rate per cent. per annum as the Company or (in the case of an interim dividend) the Directors may determine, not exceeding the rate of 5 p.ct. per annum, or a rate less than £5 2s. 6d. p.ct. by 6d. p.ct. in respect of each penny or part of a penny by which the price exceeds 3s. 6d. (whichever of these rates is the higher). Two years after the war is the period that it is proposed for the provision to have effect, unless extended by the Board of Trade. Annual meetings and interim dividends are provided for. [*Parliamentary Agents: Messrs. Dyson & Co.*]

The South Shields Gas Company are seeking a number of fresh powers, among them an extension of the district so as to include the parish of Whitburn; and they require authority to construct further works. The preamble of their Bill states that the nominal amount of capital created and issued (including the nominal amount added consequent upon the consolidation and conversion of the ordinary stock) is £224,820; and there has been received by way of premiums £82,606. The Company have power to raise £134,073 by the creation of ordinary stock, or (to an amount not exceeding £75,000) of preference stock. The Company have borrowed on mortgage and now owe £93,303, and are authorized to raise a further £44,692 by borrowing. There have been expended on capital account sums largely in excess of the amount raised by the issue of capital or by borrowing; and further capital outlay will have to be incurred from time to time for the general purposes of the undertaking. But it is impossible to issue stock under the unexercised powers otherwise than upon terms which would impose permanently upon the undertaking an excessive financial burden. The Company therefore desire additional borrowing powers, as well as authority to increase the maximum rate of dividend on any preference stock issued under the powers of the Act of 1904. The standard price is 3s.; and the standard rate of dividend upon the ordinary capital is 5 p.ct. The price charged for gas in the half year ending June 30, 1914, was 2s. 6d.; and the dividend on the ordinary capital as converted by the Act of 1879 was at the rate of 8½ p.ct. per annum, and upon the ordinary capital created under the Act of 1904 5¼ p.ct. The Company have been compelled to increase the price of gas to such an extent that the authorized rates of dividend were, in respect of the half year ending Dec. 31, 1917, reduced to 6 p.ct. and 4½ p.ct. respectively. And a further increase of price and reduction of dividend are inevitable. Therefore they require temporary provision as to the rates of dividend. Coming to the clauses, first the extension of limits is dealt with; and then follow clauses as to the maintenance of works and the conversion of the secondary products, with full purchase powers. A calorific standard of 475 B.Th.U. is desired. Then succeed the provisions applying to the supply of non-illuminating gas, the first of which is as follows:

> Notwithstanding anything contained in this or any other Act relating to the Company, the provisions of sections 11, 12, 24 to 34, 36, and 37 of the Gas-Works Clauses Act, 1871, shall not apply to the Company in respect of gas supplied by them for utilization for any purpose other than direct lighting (hereinafter called "non-illuminating gas"); and the provisions of the said Acts with respect to the illuminating power, calorific value, pressure, or purity of gas supplied by the Company, and the testing thereof, or with respect to the price of gas, shall not be applic-

able in respect of non-illuminating gas supplied by the Company, or to the Company in respect of non-illuminating gas; and the Company may charge, in respect of non-illuminating gas supplied to the occupier of any premises within the limits of supply of the Company, such sums as may be agreed between the Company and such occupier as aforesaid.

Clauses on the lines of those applied to power gas appear; and then it is enacted that—

The Company shall not supply non-illuminating gas for the purpose of direct lighting, and no non-illuminating gas supplied by the Company shall be used for that purpose; but the Company may supply, and any person may use, non-illuminating gas for lighting by means of incandescent burners.

If any person supplied by the Company with non-illuminating gas shall use the same in contravention of the provisions of this section, the Company shall forthwith upon becoming aware thereof discontinue the supply.

If the Company act in contravention of the provisions of this section, they shall for every such offence be liable to a penalty not exceeding £20 and to a penalty not exceeding £5 for each day during which such offence shall continue after conviction thereof.

The Company shall not, under the powers of this Act, supply, or continue to supply, non-illuminating gas otherwise than in accordance with any regulations, and upon, and subject to, any terms and conditions which shall have been so made or imposed, and shall for the time being be in force: Provided that, if in the opinion of the Company compliance with any such regulations, terms, and conditions would render the supply or continued supply of non-illuminating gas by them unremunerative or impracticable, it shall be lawful for the Company, upon giving to all consumers of non-illuminating gas supplied by them not less than three months' notice of their intention so to do, to discontinue such supply, and in that event the Company shall not be under any obligation to supply, or to continue to supply, non-illuminating gas to any person.

The Company also seek powers to purchase gas from other companies, bodies, and persons. Regarding the additional borrowing sanction, they desire to be authorized to borrow (together with the £98,303 borrowed under previous Acts) one-half of the capital existing immediately before the passing of the present measure, and one-half of any capital still to be raised under the powers of the 1904 Act. It is also desired to extend the limit of dividend on new issues of preference stock from 5 to 7 p.ct.; but this is not to alter or affect the rate of the preferential dividend on any preference stock created and issued before the passing of this Bill. The temporary provisions as to dividends on the ordinary stock are as follows:

Notwithstanding anything contained in section 34 [Price of Gas] of the Act of 1879, or in section 46 [Limitation of Profits] or section 47 [Standard Price] of the Act of 1904, the dividends payable by the Company upon (*a*) the consolidated stock as converted by the Act of 1879, and the new stock created and issued under the powers of raising additional capital conferred by that Act and by the Act of 1886, and (*b*) the ordinary stock created and issued under the powers of the Act of 1904, and any ordinany stock to be created and issued under the powers of that Act respectively, in respect of the half year ended on June 30, 1918, and any subsequent half year during any part of which the price charged by the Company for gas supplied by them in the county borough of South Shields, the borough of Jarrow, and the urban district of Hebburn shall have exceeded 2s. 6d. per 1000 c.ft. shall be at such respective rates per centum per annum as the Company may from time to time determine, not exceeding the following (that is to say):

(1) As respects the stock (*a*) hereinbefore referred to a rate less than 8½ p.ct. by 1s. on every £100 of such stock in respect of each penny or part of a penny by which such price exceeds 2s. 6d., and so in proportion for any fraction of £100 of that stock; and

(2) As respects the stock (*b*) hereinbefore referred to a rate less than 5¾ p.ct. by 6d. on every £100 of such stock in respect of each penny or part of a penny by which such price exceeds 2s. 6d., and so in proportion for any fraction of £100 of that stock.

The foregoing provisions are to cease to have effect from the end of the year terminating on or next after the expiration of two years from the conclusion of the war, or such longer period as the Board of Trade may think fit. [*Parliamentary Agents: Messrs. Dyson & Co.*]

The South Suburban Gas Company's Bill is of varied character, proposing as it does the acquisition of the undertaking of the Dartford Gas Company, and embodying several other matters of interest and significance. From the preamble it is gathered that the issued capital of the Company consists of £60,000 preference stock, entitled to a fixed preferential dividend of 5 p.ct. per annum, £952,795 ordinary stock entitled to a standard dividend of 5 p.ct. per annum, and £135,000 West Kent ordinary stock, entitled to a standard dividend of 5 p.ct. per annum. There has also been created and issued 5 p.ct. debenture stock to the nominal amount of £187,558, and upon the issue thereof premiums amounting to £34,989 have been received. The Dartford Gas Company have an issued capital of £89,846 of consolidated stock and £20,000 ordinary stock, which stocks are entitled to a dividend at a rate not exceeding 5 p.ct. per annum. The Dartford Company are empowered to raise a further sum (including premiums) of £55,000 by the creation and issue of further amounts of ordinary stock. They have also created and issued 4 p.ct. perpetual debenture stock to the nominal amount of £7500, and are entitled to raise an additional £47,448 by the creation and issue of further amounts of debenture stock. There are other matters referred to in the preamble, but we will only allude, before coming to the clauses, to the position in regard to the question of dividends. The dividend upon the ordinary stock of the South Suburban Company is subject to decrease or increase below or above the standard rate of 5 p.ct. per annum by 1s. 8d. in respect of any half year on every £100 of stock for each penny by which the price charged by the South Suburban Company for gas supplied by them in that half year exceeds, or is less than, the standard of 2s. 9d. per 1000 c.ft. The dividend on the West Kent ordinary stock is subject to decrease or increase below or above the standard rate of 5 p.ct. per annum by 1s. 8d. in respect of any half year for each penny by which the price charged by the Company exceeds 2s. 9d., or is less than 2s. 4d. per 1000 c.ft. The price charged in the half year ending on June 30, 1914, was 2s. 3d. per 1000 c.ft., at which price the authorized rates of dividend upon the ordinary stock and the West Kent ordinary stock were respectively 6 p.ct. and £5 3s. 4d. p.ct. per annum. But owing to the great increase due to the war in the cost of materials and to other causes attributable to the war, the price of gas has been increased to such an extent that the authorized rate of dividend upon the ordinary stock and upon the West Kent ordinary stock was in respect of the half year ending on Dec. 31, 1917, reduced to £4 6s. 8d. p.ct. per annum. And the further inevitable increase in price will result in an additional reduction of the authorized rate of dividend. Turning to the clauses, the principal terms of transfer of the Dartford Gas Company's property are the issue to the holders of consolidated stock or ordinary stock of 5 p.ct. debenture stock of the South Suburban Company in the proportion of £105 for each £100 of such stock held by them; and the holders of the 4 p.ct. debenture stock of the Dartford Company are to receive £80 of 5 p.ct. perpetual debenture stock of the South Suburban Company for each £100. The Company ask for powers to the issue of the requisite stock. Provision is made for utilizing the unexercised powers of the Dartford Company as to the raising of capital. Each of the Directors of the Dartford Company is to receive a sum equivalent to seven years' purchase of the annual remuneration of his office; and the Auditors are to be paid a sum equal to three years' purchase of their remuneration. Provision is made for compensating or taking over the officers of the Dartford Company, and for the continuation of pensions. As to the price of gas in the Dartford district, it is proposed that from July 1, 1918, to the like date in 1923, the price shall be 2d. per 1000 c.ft. in excess of the price in the South Suburban district; and from the latter date the price charged will be the same as in the South Suburban area. Coming to the miscellaneous clauses, the Company propose to acquire an easement or right of making, maintaining, or using the railway siding at Erith authorized by the Act of 1914. Powers are also desired to enter into and carry into effect contracts and agreements with any company, body, or person for the sale of electrical energy generated by the Company which they do not require for the purposes of their undertaking. The Company also ask for authority to enter into agreements and arrangements for carrying on the electrical undertakings of any company, local authority, body, or person, or of the supply to such undertakings of electrical energy in bulk, or heat or power or any means of producing heat or power, and the provision by either party of capital or funds for these purposes. The succeeding clause is to confer power on the Company to supply gas for use for mechanically propelled vehicles, and to make such charges for the gas as they may think fit. Regarding the supply of non-illuminating or power gas, this clause appears:

Notwithstanding anything contained in sections 62 [Provisions as to Charges, &c., and Conditions in Respect of Gas supplied for Power], 63 [Conditions as to Quality of Power Gas Supplied], 64 [Power Gas not to be Supplied for Illumination], 65 [Home Secretary may make Regulations as to Supply of Power Gas], and 66 [Provisions as to General Acts relating to Power Gas] of the Act of 1912, or in any of those sections, the South Suburban Company may supply power gas for utilization for any purpose, and any person to whom power gas is supplied may use the same for any such purpose. Provided that power gas shall not be supplied by the South Suburban Company or used by any person for the purposes of illumination otherwise than by means of incandescent burners.

It will be remembered that the calorific standard does not extend to the whole of the Company's area; and the Company now ask for authority to apply it, by agreement with the local authority, to any part of the district still under the illuminating power standard. Annual meetings and interim dividends are provided for, as well as power to grant pensions. Regarding the temporary provisions as to dividends on the ordinary stock and West Kent ordinary stock, it is proposed that the following shall obtain:

(1) For the purpose of determining the rate of dividend payable by the South Suburban Company upon their ordinary stock in respect of the half year ending on June 30, 1918, and any subsequent half year, during any part of which the price per 1000 c.ft. charged by the South Suburban Company for gas supplied by them shall have exceeded 2s. 3d., section 2 [As to Standard Price and Rate of Increase or Decrease of Dividend] of the South Suburban Gas Act, 1906, shall be read and have effect as if the standard price prescribed by that section had been 3s. 6d. instead of 2s. 9d. per 1000 c.ft.

(2) The provisions of sub-section (1) of this section shall extend and apply to the dividend upon the West Kent ordinary stock in respect of the half year ending June 30, 1918, and any half year

commencing after that date, and before the passing of this Act, as if that stock had during the whole of the said half year or half years been ordinary stock.

These provisions are to have effect as from the end of the half year terminating on or next after the expiration of a period of two years from the conclusion of the war, or for such longer period as the Board of Trade may determine, and the Board may also reduce to such extent as they may deem equitable the standard price of 3s. 6d. Another interesting clause is the following:

If, and whenever the rate of dividend authorized in accordance with the Acts of, or relating to, the South Suburban Company to be paid upon their ordinary stock in respect of any half year is less than 5 p.ct. per annum, the South Suburban Company may withdraw from their reserve fund, and distribute among the holders of the said ordinary stock in respect of that half year by way of addition to the dividend payable at the said authorized rate, such an amount as shall increase the dividend payable at the said authorized rate to the equivalent of a dividend at a rate not exceeding 5 p.ct. per annum on the said ordinary stock. The provisions of this section shall extend and apply to the dividend upon the West Kent ordinary stock in respect of the half year ending on June 30, 1918, and any half year commencing after that date and before the passing of this Act, as if such stock had during the whole of the said half year or half years been ordinary stock.

There are a number of financial provisions as to the conversion of existing preference stock and West Kent ordinary stock into debenture stock and ordinary stock, the creation and issue of ordinary and preference stock to the amount of the existing preference stock converted, the issue as preference stock authorized as ordinary stock, and the issue of redeemable preference and debenture stock. [*Parliamentary Agents: Messrs. Dyson & Co., with Messrs. Blyth, Dutton, Hartley, and Blyth as Solicitors.*]

ELECTRICITY SUPPLY MEMORANDA.

THE "Electrical Times" asserts that one of the first effects of the report of the Coal Conservation Sub-Committee of the Reconstruction Committee is to cause the administrations of electricity concerns to enter upon a policy of living from hand to mouth in regard to extensions. This may or may not be correct; but we have no doubt that the report has resulted in some increase of the uncertainty that began to be engendered when the Board of Trade Committee was appointed. If this is the case, it will exactly meet the views of Mr. C. H. Merz and his disciples. A standstill policy will assist their case in a manner upon which they themselves could not suggest an improvement; and it will also help to show, when the days of reconstruction set in after the war, that existing undertakings are unable to meet the demand for electric power, for which industries, it is anticipated, will be clamouring in order to revive and enlarge production on economical lines, which will not only discourage, but will beat the competitors of enemy countries. This country stands to lose everything, so inflamed electrical imagination supposes, if there is not cheap electricity available in every industrial nook and corner. This assumes that Germany and Austria will be in a position to start from the day of the declaration of peace as though nothing had happened in the nature of war, and electrical development and industrial and commercial pursuits had been proceeding with the same regularity as in pre-war times. The fact is, however, that Germany and Austria have been keeping their men employed to the fullest possible extent on war work and immediate necessities; and the conditions of the countries have been, by all accounts, much worse than anything that has been approached in this one. Impatience must not be allowed to upset reason. Financial restrictions, as well as the position of materials and men, compel the living from hand to mouth without any express adoption of a policy in that direction. Besides, there is nothing definite as yet other than a very rough outline of a scheme; and no one has any authority for saying that the rough outline depicts, even in the most general way, the best method of solving the problem of electrical generation and distribution. "Meteor" finds in the Committee's report matter for keen anxiety. He asks whether it contains the nucleus of a sound scheme? "Nobody in this country, certainly no member of the Committee, has actual experience of the conditions which the report seeks to impose." "It is like getting out the scantlings for a Cunard liner, with only the experience of a Thames steam launch." And, again, "we have serious misgivings as to the cost of transmission and distribution if super-concentration is to take place. Let the various Committees show us forty or fifty stations instead of sixteen; let them condescend to discuss transmission losses, instead of evading them. Then we shall have taken a step or two in advance."

Doubts and Delay.

Preferential Powers and an Attack on Liberty.

The attitude that local authorities will display towards any super-concentration scheme is well illustrated by the wholesale opposition that is being generated among those in the area of the Yorkshire Electric Power Company. The Company have always had ambitions and schemes much in excess of anything Parliament is prepared to grant; and their schemes suggest that the idea exists that a Power Company should have the right to ride roughshod over all other interests. The Company have a Bill in Parliament this year which proposes an enlargement of area; and one of the provisions contemplates compulsion upon electrical distributors in the area to take a bulk supply, apparently in place of making plant extensions. Naturally, local authorities owning electricity supply undertakings and some who do not, but who are looking forward to doing so, are up in arms against this impudent attack on their liberty and statutory rights and privileges, which must be repealed before any such force as that proposed could be applied. In modern Gas Acts, permissive power is incorporated to supply in bulk or to purchase in bulk; and this power no doubt the Yorkshire Company already possess, and with it they will, we should imagine, have to be content. Parliament is not likely to confer upon a Company of this kind preferential consideration. The Company have tried to secure preferential powers before. They failed; and failure is likely to be their lot in this matter of compulsory purchase from them. The Electrical Distribution Company of Yorkshire have also lodged Provisional Orders with the Board of Trade. The Local Authorities concerned in the Bill and the Orders have been scrutinizing them very carefully; and it is not remarkable that there is almost unanimity in the resolve to offer strenuous resistance to the proposals of the two Companies. The usual sneer as to parochialism will no doubt be made by the super-stationists.

Cost of Transmission.

"Meteor" cannot dislodge from his mind, and there is good justification for this, the fact that, in connection with the scheme for a few super-stations for the generation of electrical energy, the whole story of the cost of transmission has not been told; and he wants those concerned to investigate this, and to say something authoritative about it. Whichever way our friend turns, he picks up evidence that the costs of transmission are heavier than is usually supposed. His recollection informs him that a few years ago he obtained figures which showed that the cost of power from Niagara was more than doubled by a transmission of about 100 miles. The latest particulars upon which he can lay hands are for 1914; and in that year the price charged at Niagara per horse-power-year was $9—this for 12,000 volt three-phase current. Comparing this price with the charges some little distance away, we find that at Toronto, which is about 90 miles off, the price becomes $15. At Windsor, which is given as actually 233 miles from the Falls, the $9 becomes $38. The town of St. Thomas is about 140 miles from Niagara Falls; and the price charged to the municipality is $28 per horse-power-year. On the other hand, Dundas is about 50 miles away from the Falls, and the price is $15, as at Toronto. These figures, "Meteor" says, are affected by such things as load factor; but they include interest and depreciation. They give much food for thought in connection with the question of transmission.

Electric Cooking—From Large to Small Installations.

Some electricians are swelling with pride over the potentialities of electric cooking. What gas can do, electricity can do better, is the view that is held in some quarters, and quite naturally. Electricians would be very foolish and unwise to entertain any thoughts to the contrary. They would never gain even a few yards of territory from the gas enemy if such things as first cost, maintenance, working costs, reliability, and the limitations due to the low thermal value of electricity exercised any restraint. At the same time, we hope that in most cases they are sportsmen enough, and honest enough, to go about the business of getting custom without hitting their chief rival below the belt. Apparently such detestable conduct does not in the slightest trouble "Electrical Industries." In a comment the other day upon the paper read by Mr. W. A. Gillott (to which allusion has recently been made in the "Memoranda"), it is admitted by our contemporary that at present there is not much chance for domestic electric cooking, that the line of advance will be from large installations to small, and that the domestic consumer will get his main impulse towards electric cooking from the examples of the hotels, restaurants, and factories. Very well! Optimism is quite good, if a too narrow view is not taken from a few isolated instances of adoption, and sufficient count is made of the movements of the chief competitor—movements with the objective of economy in manner that is impossible with electricity, unless it is given away to the user of it for heating and cooking. Even at the present time, economy in initial, maintenance, and working costs are on the side of gas; and its reliability is something with which electricity cannot compete—electricity being subject to mishaps right from the generating station through to the apparatus whereby it is used, and, in the large installations where it is employed, there is fearful and wonderful complication. In the "Electrical Times" for Dec. 20, there was given an illustration of an electric cooking switchboard at Newcastle, comprising nine main switch panels, and controlling some 250 KW. of equipment. This does duty for a restaurant which serves about 1500 meals a day—a "meal" (electrically speaking) may be constituted of anything from a poached egg, a rasher of bacon, or even a jam tart, with adjuncts that are not electrically cooked. Publication of the photograph among hotel, restaurant, and factory proprietors would be enough to frighten them from any venture in electric cooking.

Hitting Below the Belt.

The courageous and chivalrous writer in "Electrical Industries" thinks it quite a fair thing to utilize the period during which the country is demanding from the gas industry the utmost it can extract from its gas, and then pays it a price for it that barely covers working expenses, to urge the shortcomings of gas as a reason for consideration of the virtues of electric cooking. If electric cooking has to take advantage for its advance of the conditions of the gas industry imposed by national necessity, it must be very hard up for those intrinsic merits—among which economy must rank as important—that appeal to householders and others in the medium they select for cooking. However, we will treat the writer fairly by quoting the exact phrases he used in showing his anxiety for the electrical industry having recourse in commercial warfare to U-boat tactics. Here is the first specimen: "In any case, the conditions are very favourable to a forward movement in heavy electric cooking. They have been rendered more favourable by the difficulties which have overtaken the gas undertakings. Not only has the quality of the gas deteriorated, but the pressure has been lowered so frequently that efficient cooking in gas-stoves has become almost impossible." The construction of these sentences shows the absurdity and lack of knowledge of his subject of this chivalrous writer. "Efficient cooking in gas-stoves has become *almost* impossible"—that is to say, notwithstanding the deterioration and the asserted variation of pressure, "efficient cooking" has not become impossible, but only "almost" so. A miss is as good as a mile. Now, as a matter of fact, where coal is of a respectable quality, the deterioration of the calorific power of gas by what is being done for the nation and the Allies by British gas undertakings is not more than 5 p.ct.; and so, taking the standard of 500 B.Th.U. per c.ft., it is easy to calculate that the total depreciation of calorific value does not actually amount to very much. Regarding the variation of pressure, this is only traceable to the areas where an enormous strain has been put upon gas-works through requirements for munitions production, where the growth of demand cannot be kept pace with owing to the disabilities in regard to materials and men, or where the deliveries of coal have been insufficient. In the areas with which we have personal practical acquaintance, the statement of "Electrical Industries" is foolishly inapplicable. However, let us go on to show further the methods that this writer advises: "Advantage should certainly be taken, whenever favourable, of the discontent which householders feel in an increasing degree with the inefficiency of gas cooking. . . . The least that can be done is to remind the public that the uncertainties of gas are not reproduced in electricity supply. Pressure and quality are non-variables in electricity supply." Even the last passage is untrue. Pressure is variable in electricity supply, and inconstancy of supply is something which has brought from the householder anathema on the electrical apparatus. As to the "discontent" of householders, gas undertakings have been unable to find materials and men to keep level with the orders that have come from the existing consumers, without taking into account the orders that have been pressed upon them by those who wish to become consumers of gas, and among these are users of electricity. Between fact and fancy, there is sometimes a great gulf; and it is so in the case of the foolish and ungenerous statements of the writer in "Electrical Industries." It should be remembered by him that the gas industry is constituted of a large number of undertakings—something like 1600, including statutory and non-statutory ones—and that experiences in connection with one or two may not exemplify what is general.

Heating Coroners' Courts.

The writer of "Cooking and Heating Notes" in the "Electrical Times" has, like the "Electrical Review," found considerable satisfaction in the recent publication by Dr. Waldo of his indictment of flueless gas-radiators as a means of heating improperly ventilated coroners' courts. But both our electrical contemporaries have apparently overlooked the criticisms of the report that appeared in the "Memoranda" for Dec. 25 and Jan. 8, as well as the special article published on Jan. 15 (p. 109). Now that attention is called to these various criticisms, we have not the slightest doubt that both papers will be eager to severely deal with them, and expose their technical errors, and any other wrong of which we have been guilty. The "Electrical Times," it is a pleasure to note, does publish the fact that the three electric radiators are insufficient to warm the Southwark coroners' court—that in cold weather, with doors and windows closed, the highest attainable temperature is 55° Fahr. But the trouble, it says, can be remedied by substituting electric-fires of greater heating capacity. Quite so; but at what cost per hour for heating, as compared with modern gas-fires supplying an equivalent amount of heat? It is stated that no doubt larger electric-fires will be installed. Would it not be better to ascertain first whether cheaper and more efficient means of heating cannot be introduced? It is a pity to pay more for a given amount of heat than is necessary, or not to have the advantage of more heat for the same amount of money.

Sir William Heerlein Lindley, for many years Engineer-in-Chief of the City of Frankfort-on-Main, whose death was recently recorded, left property of the value of £15,088.

A FRUIT AND VEGETABLE EVAPORATOR.

THE question of food is so much in people's minds, that a cordial welcome awaits any practical suggestion for relieving the somewhat troublesome situation which exists now and seems likely to continue for some time to come. For many things—such as meat, milk, and flour—the general consumer is, of course, dependent upon the farmer; but in the matter of fruit and vegetables he is becoming far more self-supporting than has hitherto been the case. Shortage caused by the war has thrust into the front rank of popularity "home-growing;" and this popularity, it is safe to say, will remain long after the fighting has ceased. The trouble is that, with fruit and vegetables, there is apt to be an over-abundant supply at one period of the year, and so very, very little at others. This is a difficulty which must be overcome. Conservation of supplies by the storage of surplus produce is imperative; and growers, both professional and amateur, may even now begin to consider how best they may deal with the produce which they will hope in due time to gather in.

For their benefit, a new gas-heated fruit and vegetable evaporator has been designed by the Davis Gas-Stove Company, Ltd., of No. 60, Oxford Street, W. It is on simple lines, and safe in use. The apparatus is made in two sizes—one requiring, to maintain a temperature of 140° Fahr., an hourly gas consumption of 9 c.ft., and the other 12 c.ft. The drying chamber is fitted with a series of eight removable trays, each consisting of a strong wire base, wood-framed sides, and sheet-iron slides. Between each tray is a sheet-iron division-plate, so arranged that during the evaporating process the moisture arising from any one tray is prevented from passing to the tray above it. The casing is of sheet iron, and is mounted on angle-iron legs. Evaporation is effected by an atmospheric burner, connected to the door of the burner-chamber at the bottom of the stove by means of a swivel joint. It swings-out for lighting with the opening of the door. At the side of the oven door a thermometer enables the evaporating temperature (normally 140° Fahr.) to be regulated and maintained at the desired point, by means of an exterior control valve fitted to the burner. While the heating of the chamber is both rapid and uniform, the arrangement of the division-plates between the trays ensures that the heated air from the burner-chamber shall pass under, through, or over the trays, and then into the flue with the moisture evaporated from the produce under treatment.

As to the working results of this useful apparatus, it need only be pointed out that severe practical tests are stated to have demonstrated that the evaporator fulfils its purpose with complete efficiency, and with a very low consumption of gas [the figures for which have already been quoted]. At the same time, the produce treated in it has been found to preserve its natural flavour in the dried state, and to resume practically its normal characteristics when re-hydrated even after a considerable period has elapsed. Instructions for drying various fruits and vegetables have been prepared by the Davis Gas-Stove Company, which will be found very useful by those who determine to give a trial to this convenient method of storing.

PROF. J. W. COBB'S ANNUAL REPORT.

IN his fifth annual report, Prof. J. W. Cobb, Livesey Professor in the Department of Coal Gas and Fuel Industries (with Metallurgy) at the University of Leeds, states that the number of registered students during the 1916-17 session was naturally small, owing to war conditions. During the session, eight special evening lectures on "Bye-Product Coking" were given by Mr. Greaves, two on the "Washing of Town Gas with Oil and Tar" by Mr. A. Edwards, of Leeds, and six on the "Scientific Utilization of Fuel" by Prof. Cobb. Mr. H. J. Hodsman, M.Sc., has been appointed Lecturer in Gas Chemistry. With the collaboration of Dr. S. F. Dufton, satisfactory progress was made with an investigation into the breakdown of toluene, benzene, and allied compounds; and interesting results have already been obtained. An investigation was started, in collaboration with the Institution of Gas Engineers, into the relative efficiencies in practice of various grades and compositions of coal gas, to the expenses of which the Institution granted £450 the first year. Mr. J. W. Wood, M.Sc., has been appointed Research Chemist for carrying out the experimental work, and is now occupied with it. The Birmingham Gas Department have offered valuable facilities for carrying out certain parts of the investigation for which a university laboratory is unsuitable and gas-works equipment of a special kind is essential. Further facilities have been offered at Leeds and other places. Moreover, the leading gas companies and authorities are placing at the disposal of the department the records of their own experiments and inquiries. The control work undertaken in the department for the Ministry of Munitions in connection with the recovery of benzene and toluene from coal gas is being continued. Mr. J. J. Parker, who, after serving in the Chemical Corps in France, was assisting Professor Cobb in the examination of tars, benzols, and wash-oil for the Department of Explosives Supplies, has entered a wider sphere of work for the same Department, in the inspection of oil-washing plants for the recovery of toluene and benzene in gas-works.

REVISED SCHEDULE OF PROTECTED OCCUPATIONS.

ON Feb. 1 there will come into operation a revised schedule of protected occupations, which embrace Admiralty, War Office, and munitions work and railway workshops; the object of the revision being to release the greatest possible number of young men fit for general military service who are now engaged in various war industries.

As at present, only men medically classified Grade I.—that is, fit for general service—will be recruited. The minimum age of protection for Grade I. men is 24. Under the schedule hitherto in force, men have not been recruited from the Admiralty, the War Office, or munition work if they were over the age of 32. They are now liable to recruitment up to the full military age, unless they are in a scheduled occupation, where some lower age limit is fixed. A man is not entitled to claim a scheduled occupation certificate unless he can show that he was in a scheduled occupation (not necessarily with the same employer) on or before Aug. 15, 1915. Men in medical categories lower than Grade I. are not affected. It is not intended to call up such men, save in very exceptional circumstances.

Ages at which protection begins for men fit for general service have been generally raised. Except for men employed on urgent Admiralty work, the minimum appearing in the schedule is 23; but as ages are taken as at Jan. 1, 1917, the minimum will in practice be 24. This date is fixed because all returns and records are based on it. Age limits have been fixed, after consideration of the importance of the output for which the particular occupation is needed, of the supply of and demand for the particular class of labour, and of the extent to which the particular kind of work can be performed by persons other than men fit for general service. All men of military age engaged in an occupation not scheduled are liable to recruitment if they have been medically classified Grade I.

With regard to exemptions, it is explained that the scheduled occupation certificate (known as the "red card") will still hold good unless it is withdrawn. A man holding this certificate can be called up only by the local representative of the Admiralty, War Office, or Ministry of Munitions; and in that case he will receive a calling-up notice stamped by the Munitions Area Recruiting Officer. No other calling-up notice is valid. If a man thinks he is entitled to a red card, or if his card is withdrawn, he can appeal, as at present, to the Enlistment Complaints Sub-Committee direct or through his trade union on Form L.E.C. 27. The form must be sent in before the date of calling-up. If protection is withdrawn, a man can still appeal to a tribunal on personal grounds (for instance, domestic hardship) in accordance with the regulations and instructions in force. A tribunal exemption remains valid until it expires or the tribunal withdraws it.

SIXTY YEARS AGO.

From the "Journal" for January, 1858.

Coal Consumption of the Chartered Company.—We cannot forbear alluding to a mare's nest into which the delegates [on the districting arrangements in London] have been entrapped, through a statement made by Messrs. Hofmann and Witt, in their report to the Government Referees on the plans for the main-drainage of the Metropolis, in which it is said that, "According to an estimate of George Lowe, Esq., C.E., Engineer to the Chartered Gas Company, London, the annual consumption of coal for the purpose of gas-making in London is about 840,000 tons, which would yield 7,728,000,000 c.ft. of gas. The value of this volume of gas would be (at 4s. 6d. per 1000 c.ft.) £1,738,000." The wording of the paragraph has led the delegates to believe that 9200 c.ft. of gas was sold at 4s. 6d. per 1000 c.ft. for each ton of coal consumed, whereas Mr. Lowe's share in the responsibility of the statement is limited to the estimate of the consumption of coal—an estimate which, we believe, considerably exceeds the actual quantity.

Call for an Inquiry.—The ardour of the delegates from the Metropolitan District Boards for a parliamentary inquiry into their grievances, seems to be somewhat abated, if their proceedings at the last meeting are to be taken as a criterion of their present feelings. The leaders of the movement are possibly aware by this time that the substantial question for investigation is not whether the Gas-Works Clauses Act of 1847, or some more stringent control, should be applied to the Metropolitan Gas Companies, but whether the public lights ought to be supplied with gas at a lower price than is paid by the private consumer. The inaction of the Companies themselves is indicative of their readiness to accept the challenge thrown out by the leaders of the Marylebone movement, and to submit the whole question to the arbitration of a Parliamentary Committee. They probably foresee that one of the consequences may be an assimilation of the charge for gas to both public and private consumers, under the authority of the Legislature; and, as there are numerous precedents for such a solution of the dispute, their expectations in this respect may not be disappointed.

TOLUOL BY CRACKING SOLVENT NAPHTHA IN THE PRESENCE OF BLUE GAS.

Writing on this subject in the "Journal of Industrial and Engineering Chemistry," published by the American Chemical Society, Mr. Gustav Egloff says that one of the fruitful fields for increasing the toluol yield is by stripping carburetted water gas, coal gas, and oil gas, by means of suitable scrubbing towers, for their toluol content. But, to pass the sorely needed legislation, to change from a candle power to a heat standard will take time, unless the War Department, as a military necessity, commandeers or orders the erection of gas-scrubbers in every commercial-sized gas plant in the country. And anyway it will take time to build scrubbers for the various gas plants. To quickly add 2,000,000 gallons of toluol to the supply, he suggests the use of water-gas machines to crack solvent naphtha and produce toluol in the presence of blue gas.

It is calculated that there will be produced, in the year 1917, 15,000,000 gallons of solvent naphtha, from which about 2,000,000 gallons of toluol can be made by cracking solvent naphtha in carburetted water-gas machines. A more than sufficient number of carburetted water-gas machines are already installed throughout the country to take care of the cracking of 15,000,000 gallons of solvent naphtha, from which 2,000,000 gallons of toluol can be quickly made.

SOLVENT NAPHTHA USED.

The solvent naphtha used in the following experiment was derived from the thermal decomposition of coal, and analyzed—using a standard Engler flask for distillation and the Westphal balance for specific gravity.

Distillation Analysis.

Sp. Gr., 0·867/15·5° C.

Temp. ° C.	P.Ct. by Volume.
135·5	1st drop
140·0	49·1
150·0	87·0
160·0	91·5
170·0	96·3
180·0	98·5
183 5	Dry point

CRACKING TEST.

The following test of cracking solvent naphtha was conducted upon a Lowe carburetted water-gas set, over a period of 48 hours. The operation of the plant in cracking solvent naphtha in the presence of blue gas for toluol is practically the same as when cracking gas oil in ordinary carburetted water-gas making, with the exception that the gallonage per hour of solvent naphtha into the cracking zone is higher. The data upon a 24-hour basis averaged as follows for a carburetted water-gas set:

Make per set per day of gas formed	500,000 c.ft.
Candle power of the gas	21 at 21° C.
Candle power of gas per gallon of oil	1·75 at 21° C.
Solvent naphtha cracked per 1000 c.ft. of gas formed	12 gallons
Gas per gallon of solvent naphtha cracked	83·3 c.ft.
Coke used per 1000 c.ft. of gas	46 lbs.
Steam used per 1000 c.ft. of gas	38 lbs.
Temperature of superheater base	825° C.
Temperature of condenser outlet	15·5° C.
Length of run	4 min.
Length of blow	4 min.
Rate per hour of solvent naphtha	250 gallons
Rate of actual flow of solvent naphtha into system	500 gallons
Total gallonage of solvent naphtha passing through set in 24-hour day	6000 gallons
Light oils collected in drips and seals	57 p.ct.
Tar in gasholder	15 p.ct.

ANALYSIS OF LIGHT OIL.

The light oil was distilled in a one-barrel still with steam to a temperature of 170° C. This cut was analyzed by a method already devised for the benzene, toluol, and solvent naphtha content.

The analysis showed on the basis of light oil recovered from the cracking of solvent naphtha the following percentages of aromatic hydrocarbons:

	P.Ct.
Refined benzol	14·5
Refined toluol	23·7
Refined solvent naphtha	19·8
Crude heavy naphtha	9·7
Dead oil	14·0

On the basis of 100 gallons of solvent naphtha cracked, the following percentage of aromatics can be recovered:

	P.Ct.
Refined benzol	8·3
Refined toluol	13·6
Refined solvent naphtha	11·2
Crude heavy naphtha	5·5
Dead oil	8·0

In these critical times, with a high scarcity of toluol, no quicker method lends itself to adding to the toluol supply than the cracking of solvent naphtha in carburetted water-gas machines. This is due to the fact that there is more than a sufficient number of carburetted water-gas machines already in operation, which could be used at once without any change, for the adding of 2,000,000 gallons of toluol to the much-needed supply.

COMPARATIVE VALUES OF COKE-OVEN CRUDE BENZOLS.

By B. WILSON HAIGH and HAROLD LAMB.

[A Paper read before the Midland Section of the Coke-Oven Managers' Association.]

Much valuable light has been shed on the formation of the aromatic hydrocarbons produced in the destructive distillation of coal; and much care and ingenuity have been exercised in devising methods for the quantitative estimation of the principal constituents—benzene, toluene, and naphtha. Though some careful work has been done in investigating the conditions most favourable for the production of benzene and its homologues in the process, yet it would be hardly truthful to say that the information so far published on the subject carries our knowledge very far. Various proposals have been made and tried for increasing, for instance, the proportional yield of toluol; but they do not appear to have met with any very general application. Most of those present are concerned with the working of benzol plants with the design and lay-out of which they have had little or nothing to do; their business being to work them to the best advantage, so as to recover from the gas the maximum yield of the saturated hydrocarbons previously referred to.

SOME PRELIMINARY CONSIDERATIONS.

It might be thought that, during the years that have elapsed in which benzol has been recovered in connection with coke-oven plants, those who have charge of such plants would have become pretty well agreed on the conditions essential to obtain the utmost efficiency. But this by no means seems to be the case. For instance, there is no fixed idea in the minds of some as to what is the most suitable degree of pre-heat to impart to the benzolized oil before it enters the still, nor yet what is the ideal temperature to aim for when the oil leaves the still. These are matters of great importance; for on them depends to a large extent whether or not the plant works efficiently. If the debenzolized oil leaves the still at a temperature below 100° C., it is almost sure to contain such a percentage of water as will seriously interfere with its efficiency as an absorbing medium; and the experience of the writers leads them to aim at obtaining an exit temperature of not less than 105° to 110° C.

In a paper read before the North of England Gas Managers' Association in 1915,* Mr. W. Diamond stated that the water in washing oil should not exceed 1 p.ct., and that if it rose to 2½ p.ct. the efficiency was reduced by over 35 p.ct. He also stated that 7·5 p.ct. of water reduces the efficiency by 45 p.ct., and 10 p.ct by 73 p.ct. While the writers' experience does not quite bear out these high losses, yet they would emphasize the importance of keeping the oil as dry as possible, or the benzol that escapes unabsorbed is very appreciable. It is important, too, to see that the oil is properly stripped in the still; for if there is much distillate left in that should ordinarily be recovered as 65 p.ct. crude—say, more than 0·1 p.ct.—there will again be loss in scrubbing.

The chart given by Taylor,† showing the amounts of 70 p.ct. benzol in equilibrium with benzolized creosote of specific gravity 1·070, is very useful in this connection. It shows, for instance, that if the debenzolized oil at 19·5° C. contains 0·25 p.ct. of benzol, there will be a loss of benzol in the return gas of nearly 0·3 gallon per ton of coal. This, on a plant carbonizing 2000 tons of coal per week, would amount to nearly 600 gallons of benzol in this period—worth to-day £25 to £30. Numbers of tests made on the plant with which the writers are connected have confirmed in different parts of the chart the substantial accuracy of the curves shown thereon.

TEMPERATURES, OIL SATURATION, AND DESIGN OF PLANT.

Another important factor is the comparative temperatures of the scrubbing oil and gas. If the temperature of the scrubbing oil is allowed to fall below that of the gas passing through the scrubbers, moisture from the gas is likely to be condensed out, and the scrubbing efficiency is thereby reduced. Again, there is diversity of opinion, where tower scrubbers are in operation, as to the best method of saturating the oil, and also the degree of saturation to aim for. Some incline to the view that it is best to circulate large volumes of oil through all the scrubbers, while others take good care that only the quantity of debenzolized oil going away from the still is passed through the distributors in the last scrubber of the series. The writers incline to the latter as being the proper method; and while they do not advocate a low degree of saturation, it is a fact that the plant at present in mind has worked efficiently with a saturation slightly under 2 p.ct.

The complaint was made after Mr. Taylor read his paper that sufficient note had not been taken of the development of the process of benzol recovery by those who have been responsible for the design of plant. We take leave, therefore, to note the design of a still by Brown and Simon-Carves, Ltd., which departs from the usual type in important details. An abridged specification, with an illustration, was published in the "GAS JOURNAL" for Nov. 20, 1917 (p. 379). The novelty consists in reheating the oil midway in the still, when the loss of heat due to latent heat consumption in converting the absorbed products from the liquid to the gaseous state has reduced the temperature below the boiling point of the highest boiling absorbed products. The oil is then heated again by indirect steam before it passes over a second series of bubbling trays. It would take too long to enter fully into the questions involved; but this seems to the writers to be a step in the right direction.

IMPORTANCE OF SCIENTIFIC SUPERVISION.

We have ventured to go over some ground again partly to emphasize to some of the younger members the importance of careful, methodical, and scientific supervision, if much benzol is not to be lost along with the gas, and also to provoke discussion. The real subject of the paper—namely, the evaluation of coke-oven crude benzols—is one that lends itself less to discussion; and the various tables of figures that are presented are given in the hope that they may prove useful for reference and further study when they appear in permanent form.

The general adoption of the practice of benzol rectification on coke-oven plants has turned the attention of the technical staffs to the composition of the crude material. Formerly the object of the chemist of every coke-oven plant was the production of a saleable crude benzol, conforming to the standard of 65 p.ct. distillate below 120° C. in the retort test. Under such conditions the product received little attention, since its subsequent treatment was not under the control of the staff responsible for its recovery. The practice of rectification for the production of 90's benzol, or of 50/90 benzol, did not materially alter the position, since the products were mixtures of the constituent hydrocarbons—benzene, toluene, and xylene. Present-day requirements necessitate the separation of products of a considerable degree of purity; and chemists feel the need of a better knowledge of the raw material.

The established test for crude benzol has been subjected to much criticism, and its shortcomings have been much discussed. It was felt, therefore, that an investigation into the limitations of the retort test, and a general consideration of the subject, would be helpful. With this in view, the first part of this investigation was worked out.

The second part is the result of an attempt to overcome a difficulty often troubling the staffs in charge of a rectification plant. The yields of finished products are frequently expressed as percentages of the crude material treated. With varying qualities of crude benzol to treat, the problem of expressing working results in order to render them comparative has arisen. The general practice is to adhere to the standard of 65 p.ct. crude benzol (retort test), and to express the results on this basis. When working-up low-grade crude benzol, it is obvious that some deduction must be made from the volume of such material treated to permit of results being expressed on the standard basis. This correction to 65 p.ct. strength is accomplished in various ways, none of which are really satisfactory.

With the hope of setting up some satisfactory method, the following work was done. All tests in both investigations were carried out on crude benzol without preliminary treatment, since the effect of a washing operation is not known with sufficient certainty to allow of its being introduced without affecting the results to an unknown degree.

HOW THE RESEARCH WAS MADE.

The apparatus used consisted of a 250 c.c. retort with the neck shortened and fitted into a Liebig condenser. The thermometer employed was the usual naphtha thermometer, graduated in half degrees from 90° to 200° C.; and it was fitted so that the bulb was ⅜-in. from the bottom of the retort when the distillation was in progress. The interruption points in a distillation were 120° C. and 160° C., corrected. The corrections of the thermometer reading for variation in barometric pressure and for the length of column exposed to the air were applied to all the readings. The total correction to be applied occasionally amounted to 2° C. The speed of distillation was in all cases two drops per second from the end of the condenser.

A series of tests was also carried out on the same samples with another method of distillation. The most satisfactory alternative test is one similar in principle to that devised by the Government. The retort was replaced by a 150 c.c. distillation flask, such as is used in the official test. The Liebig condenser was retained; and the distillations were carried out with the thermometer bulb just below the side tube of the flask. All cylinders used were checked for accuracy of graduation, and the rate of distillation was the same as in the retort test. The thermometer used was a benzol thermometer that had been proved trustworthy in its readings. It was graduated in fifths of a degree from 70° to 130° C. The corrections for variation of the barometric pressure and for the length of exposed mercury column were applied as in the previous tests. The latter correction was obtained from the formula:

$$C = \cdot 000154\ (T - t)\ N$$

where T = the observed temperature, t the mean temperature of the exposed mercury column (obtained by fixing a thermometer with the bulb of it half-way between the cork and the top of the mercury column), and N the length in degrees of the exposed column. The total correction to be applied may be checked by testing the boiling point of distilled water under the conditions of the test.

* See "JOURNAL," Vol. CXXX., p. 267.

† See "Coke-Oven Managers' Year Book," for 1917, p. 70.

The interruption points settled upon, after considerable preliminary work, were 84°, 90°, 100°, 120°, 130° C. (corrected).

Results of Tests.

Results of this series of tests are shown graphically in fig. 1. A set of representative results only are given, in order to avoid confusion. In all, more than a hundred samples were tested; the whole range of testing from 40 to 70 p.ct. at 120° C. (retort test) being covered. In nearly every case several samples were tested, and the results compared, in order to obtain a representative test for each quality of benzol. The results have been obtained

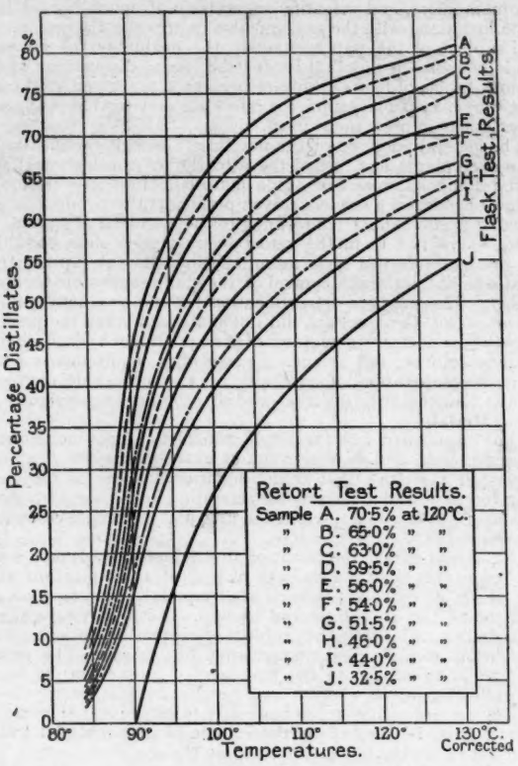


Fig. 1.—Showing the Relationship between Retort and Flask T Results.

from samples produced mainly from one plant, and show a close agreement. All the samples from which the results on fig. 1 were obtained were produced on the same plant. Unfortunately, it has not been possible to test a range of samples from any other plant, as only occasional samples have been available. Such as have been tested would tend to show that the products on different plants would have characteristic curves similar to those shown on fig. 1.

The agreement between samples of benzol of the same quality (as established by the retort test) produced by the same plant is shown in Table I.

Table I.—*Showing the Close Agreement of a Series of Samples of Crude Benzol Produced by the Same Plant.*

Sample No.	Retort Test. Distillate at		Flask Test. Distillate at				
	120° C.	160° C.	84° C.	90° C.	100° C.	120° C.	130° C.
16	56	69·0	6·0	28	53·0	69·0	71·0
17	56	70·5	4·5	30	54·0	68·5	71·5
18	56	69·0	6·0	28	53·0	67·0	71·0
38	62	75·0	9·5	36	59·5	72·5	76·0
39	62	75·0	9·5	36	59·5	72·5	76·0
40	62	75·0	6·0	31	56·5	71·0	75·0
41	62	76·0	8·0	30	58·0	73·0	77·0
42	62	75·0	6·0	31	56·5	71·0	75·0

All results expressed as percentages by volume.

These samples were produced at different times, with considerable intervals between them. The slight difference in No. 17 from Nos. 16 and 18 is shown in the larger proportion of distillate obtained at 90° in the flask test above described.

The results obtained enable the following conclusions to be arrived at:

1.—The criticism that the retort test is not reliable does not seem to be borne out if it is carefully carried out under uniform conditions and the proper corrections applied to the thermometer reading.

2.—The retort test has limitations; and these are clearly shown. It fails to show in what respect a particular benzol is abnormal and gives little insight into the relative proportions of benzene, toluene, and xylene in a sample.

Referring to Table II., the results of sample No. 3 show a much larger percentage of distillate at 90° C. in the flask test than was obtained with a set of samples of which No. 4 is representative. This was due to sample No. 3 containing an abnormally large proportion of benzene.

Table II.—*Showing the Limitations of the Retort Test.*

Sample No.	Retort Test. Distillate at		Flask Test. Distillate at				
	120° C.	160° C.	84° C.	90° C.	100° C.	120° C.	130° C.
3	46·0	69·5	—	24	45·0	66·0	70·0
4	46·0	62 5	—	17	42·0	59·5	64·5
42	62·0	75·0	6·0	31	56·5	71·0	75·0
43	62·25	79·25	6·5	23	50·5	72·0	76·5

All results expressed as percentages by volume.

Such information is valuable for the control of a rectification plant, and is easily obtained from an inspection of the results of the flask test. The reading at the interruption point 84° C. in the flask test is serviceable as an indication of the proportion of carbon disulphide in a sample. Thus, taking a series of samples from four different plants, the results in Table III. show the differences in composition as revealed by the flask test, and the test of the resulting benzol after rectification.

Table III.—*Showing the Proportions of Carbon Disulphide Present in Different Samples of Crude Benzol.*

Sample No.	Retort Test. Distillate at		Flask Test. Distillate at					Test of Rectified Benzol.	
	120° C.	160° C.	84° C.	90° C.	100° C.	120° C.	130° C.	Below 80° C.	Below 82° C.
								Per Cent.	Per Cent.
53	63·5	77·75	9·5	26·5	54·0	73	78	9·5	87
54	63·5	78·75	9·0	31·5	55·0	72	76	7·0	95
59	65·0	78·50	13·5	34·5	60·0	74	78	19·0	88
62	65·0	79·00	6 0	36·5	62·5	73	78	5·5	86

All results expressed as percentages by volume.

3.—The evidence obtained in this investigation seems to suggest the wisdom of the general adoption of the flask test as supplementary to the retort test, which, although capable of giving concordant results, is insufficiently informative for benzols produced from different plants.

No attempt is made to show the composition of the samples; the results are intended for comparative purposes only.

Calculating Comparative Values.

The aim of the second part of this investigation has been to find a simple method of comparing crude benzols of different qualities, and to arrive at a satisfactory means of easily calculating their comparative values. As is well known, crude benzol consists of benzene, toluene, and xylene, with other constituents in small proportions, and a proportion of creosote oil, depending in extent upon the conditions obtaining at the producing plant. It is obvious that a variation in the proportion of the toluene or xylene content will exercise an influence on the percentage strength of the benzol as ascertained in the retort test. Experience shows that, in a benzol produced from any particular coal, the proportions of these constituents do not vary sufficiently to materially influence the retort test result. It is therefore concluded that the creosote is the principal constituent causing the variation in strength of the crude benzol produced. The method adopted in the investigation is based on this conclusion. The procedure was to distil off from a sample the constituents valuable as rectified products, and to leave behind the creosote as a residue.

The apparatus employed consisted of a Young's rod and disc fractionating column with twenty discs, a round-bottomed flask, and a Liebig condenser. The graduated cylinders employed were carefully calibrated. The thermometer used was a naphtha thermometer graduated in half-degrees from 90° to 210° C. All readings were corrected as previously explained.

The fractionation consisted of distilling off all constituents boiling below 200° C., corrected. This temperature was settled on after a number of preliminary experiments. Several were carried out employing temperatures between 180° and 200° C. It was found that at temperatures below 200° C. the results were not satisfactory; tests of the residual oil showing in some samples the presence of a considerable proportion of the constituents of heavy naphtha. The distillations were all conducted at a uniform rate of one drop per second from the end of the condenser. The residues consisted of creosote oil having a boiling point of approximately 205° C., and were heavily charged with naphthalene. Many tests have been carried out; and a series of results covering the whole range are given in Table IV.

The results show an increase in the creosote oil content as the benzol samples decrease in quality. It is noticeable that the difference between samples testing from 63 to 65 p.ct. in the retort

TABLE IV.—*Samples from the Same Plant. Results.*

Sample No.	Test of Crude Benzol. Retort Test. Distillate at 120° C.	Retort Test. Distillate at 160° C.	Flask Test. Distillate at 84° C.	Flask Test. Distillate at 90° C.	Flask Test. Distillate at 100° C.	Flask Test. Distillate at 120° C.	Flask Test. Distillate at 130° C.	Fractionation. Distillate below 200° C.
6	46·0	62·0	—	18·0	40·5	53·0	63·0	76·7
7a	49·0	66·0	3·5	16·5	—	60·5	66·0	80 0
9	51·5	66·5	6·0	23·5	47·0	63·0	66·5	80·7
11	53·0	70·0	4·5	—	43·5	64·0	—	82·0
13	54·0	69·0	5·0	24·0	51·0	66·5	70·0	82·0
18	56·0	69·0	6·0	28·0	53·0	67·0	71·0	81·3
26	59·0	73·5	5·5	27·5	54·0	70·0	73·5	82 7
29	59·5	74·0	—	28·5	55·0	70·5	75·0	84·0
40	62·0	75·0	6·0	31·0	56 5	71·0	75·0	85·0
45	63·0	75·5	8·0	36·0	61·0	73·5	77·5	84·0
56	64·5	—	6·5	34·5	60·0	76·0	80·0	85·0
60	65·0	76·5	7·0	—	63·5	76·5	79·5	86·7
72	69·0	81·0	6·5	37·5	64·5	78·5	81·5	89·0

All results expressed as percentages by volume.

test is very slight. No. 18 is abnormal—it contains a larger proportion of benzene than the other 56 p.ct. samples tested.

A number of tests were made with samples from other plants; but as only occasional samples were available, insufficient knowledge has been arrived at respecting the variations in quality of the product from other works. There is, however, little doubt that a similar agreement could be found for any other make of crude benzol.

In Table V. these results are given; and the results of a works distillation are included. It will be noticed that the residue obtained in the laboratory distillation is always less in percentage quantity than the creosote obtained on the large scale. This is due to the works distillation being stopped for practical reasons before reaching the stage to which the laboratory distillations were taken. The difference between the results will, however, be noticed as fairly consistent.

TABLE V.—*Benzols from Various Sources.*

Test of Crude Benzol. Retort Test. Distillate at 120° C.	Retort Test. Distillate at 160° C.	Flask Test. Distillate at 84° C.	Flask Test. Distillate at 90° C.	Flask Test. Distillate at 100° C.	Flask Test. Distillate at 120° C.	Flask Test. Distillate at 130° C.	Laboratory Fractionation. Distillate below 200° C.	Percentage of Creosote on Large Scale Distillation.
65·0	78·5	13·5	34·5	60·0	74·0	78·0	88·0	14·7
62·25	79·25	6·5	23·0	50·5	72·0	76·5	90·0	14 0
61·75	73·5	11 0	36·5	59·5	71·5	75·0	83·3	23·1
63·5	77·75	9·5	26·5	54·0	73·0	78·0	86·0	17·2
63·5	78·75	9·0	31·5	55·0	72·0	76·0	88·7	..
62·5	78·5	..	28 0	53·0	72·5	78·0	88·7	14·2
64·0	77·0	11·0	33·0	58·0	72·5	77·0	85·3	..
66·5	81·0	8·5	29·5	54·0	73·0	78·0	90·0	..
64·0	81·0	7·5	25·0	51·5	70·5	76·0	91·3	..
65·5	82·25	10·5	30·5	55·0	73·0	78·0	91·0	..
69·5	81·5	6·0	34·5	61·5	76·0	80·0	89·3	..
71·5	81·0	14·0	50·0	70·0	79·0	80 5	85·3	..
63·0	77·5	5·0	26·0	55·0	71 5	74·0	85·6	..
65·0	81·0	9·0	30·0	55·0	72·5	76·5	91·3	..
63·0	80·0	3·0	22·0	52·0	71·0	77·0	91·3	..
61·0	78·0	3·0	22·0	49 5	70 0	76·0	90·3	..
64·5	81·5	10·0	29·5	52·5	71·0	76·0	92·0	..
65·5	83·5	7·5	27·0	52·0	73·0	77·0	91·7	..
72·5	81·0	16·0	45·0	68·0	78·0	80·5	87 3	..
65·5	82·5	10·5	26·0	53·0	72·0	76·0	92·0	..

All results expressed as percentages by volume.

The results of this work have enabled a comparison to be made between various benzols, and have also rendered possible the calculation of equivalence of low-grade benzol to the normal 65 p.ct. strength produced at the same plant. There is, however, much scope for an extension of this work by the testing on similar lines of ranges of samples from other works.

For the plant from which the tests given in Table IV. were obtained, the graph (fig. 2) makes it possible to correct the quantities of benzol of differing strengths, so that they may be stated in terms equivalent to 65 p.ct., provided the result of the retort test be known. In the graph nothing is allowed for the extra value of creosote recovered when weak benzols are made, as this would probably be discounted by the extra trouble involved in further treatment and by additional steam used. There is a good deal of difference of opinion as to what strength the crude benzol should be made. Some members of the Association have suggested 60 p.ct. as a better figure than the present 65 p.ct., and others one still lower. There is a danger when severe dephlegmation has to be undertaken to produce 65 p.ct., that some naphtha, toluol, and even benzol may be brought down with the heavier oils. If this is the case, it certainly seems better to have a weaker benzol; and the graph enables an adjustment of values to be made.

By some who never buy benzol for rectification, or who never have any trouble in making 65 p.ct., it might be argued that the investigation described above is of little value, or it might be further asked: Why should any plant make a product testing as

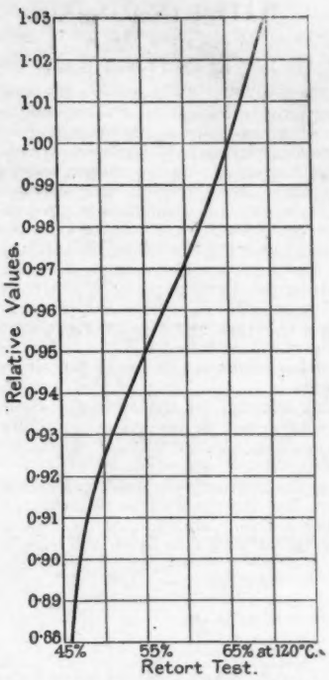


Fig. 2.—Showing the Equivalence of Low-Grade Benzols to Normal 65's.

low as (say) 40 p.ct. at 120° C.? But those who do either buy or sell will no doubt be glad to have some data to help them in adjusting differences of value when the product is either above or below strength. Various conditions may obtain to cause the production of low-strength benzol—as, for instance, the change of wash-oil, a period of low-pressure steam, water in the oil, and repairs to, or the furring-up of, the tubes of a dephlegmator. It certainly seems preferable to go on making a product of inferior quality rather than stop the plant until normal conditions can be resumed.

[The report of the discussion had not arrived at the time of making-up for press, and so has had to be left over until the next issue.—Ed. "G.J."]

Birmingham Industrial Research Laboratories.

With the object of calling the attention of the various manufacturers of the district to the existence of the industrial research laboratories which have been established by them, the Birmingham Corporation Gas Department have prepared an illustrated pamphlet setting forth the work and function of this important branch of their activities. The laboratories, which have now been actively engaged for some twelve months in assisting various manufacturing firms, were equipped with a view to collaborating with the manufacturers in carrying out work of a scientific and investigational character. Valuable research work has already been conducted—particularly in the direction of the heat treatment of metals. It is remarked that many manufacturers are still under the impression that the research work carried out in the laboratories only relates to the use of gas. This, however, is not the case. Such work is undertaken without any regard to its effect on the sales of gas. It includes the composition of metals, the heat treatment of steels, brasses, bronzes, aluminium, and the many special alloys which enter into local manufactures; physical and mechanical testing; and research work relating to electrical appliances, glassware, and problems which arise from time to time in the manufacture of articles of non-ferrous and ferrous metals. Indeed, it is declared that discoveries have been made in these laboratories which have saved manufacturers in Birmingham many thousands of pounds. A description is given of the equipment, which is shown to be of a very complete character. The laboratories are situated partly at the Council House and partly at Windsor Street Gas-Works, and are under the control of Mr. C. M. Walter, B.Sc. (Engineering), M.Inst.Met., the Engineer-in-Charge, assisted by Mr. V. E. Green, Assoc.M. Inst.C.E., Assoc.M.Inst.Mech.E., Assistant Engineer, with a staff of metallurgists and other specialists.

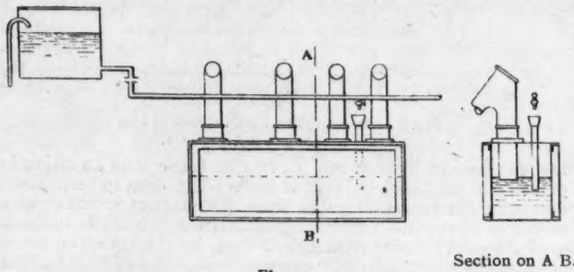
Melting-Point of Coal Ash.—In a communication last month to the Newcastle Section of the Society of Chemical Industry, on the "Melting-Point of Coal Ash," Dr. J. T. Dunn gave the results of a number of analyses of coal ashes, and showed the proportion of bases combined with a fixed weight of silica in each sample. The figures which he submitted indicated that, generally, the melting-point of the ash increased as the content of basic oxide diminished; but in the course of the subsequent discussion, Prof. H. Louis said he felt convinced that it was not only a question of the amount of basic oxides, but also of their composition.

WATER IN GAS TAR.

The decision in 1915 by the French War Department, that tar delivered to the distillers should contain not more than 4 p.ct. of water or alternatively be subject to a reduction of price, naturally had the effect of causing gas makers in France to inquire into an item of manufacture which previously, on their own admissions, they had neglected. In the current issue of the "Journal des Usines à Gaz," M. Coudelou, the Manager of the Rouen works of the European Gas Company, in a paper on this subject, states that percentages of 15, 20, 25, or even 30 of water in tar were by no means uncommon. Such proportions naturally led to the investigation of conditions under which they were produced. M. Coudelou summarizes these as (1) protracted contact with the tar of a small proportion of water; and (2) agitation of tar and ammonia liquor together to such an extent that the two form a species of emulsion from which neither substance readily separates—an emulsion which might easily contain even more than 30 p.ct. of water.

The remedies adopted for this state of things, in reference to the previously employed method of manufacture, are described as follows by M. Coudelou with the aid of the diagrams that are here reproduced.

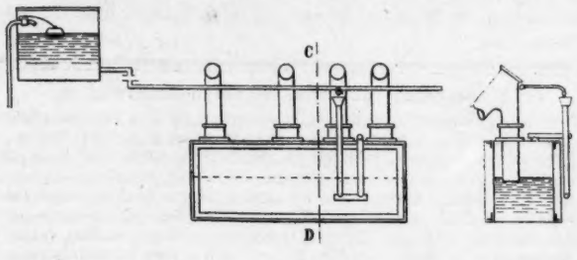
Previously in the hydraulic mains a plentiful supply of ammoniacal liquor was kept for the purpose of forming a hydraulic seal as regularly as possible. This liquor was admitted by a pipe immersed in the tar as shown at fig. 1, and thus introduced much



Section on A B.

Fig. 1.

water into the tar. This arrangement has since been replaced by that shown in fig. 2. In place of an abundant supply of liquor, only a thin stream of clear water is admitted in the proportion



Section on C D.

Fig. 2.

of about 2 gallons per 1000 c.ft. per 24 hours. The strength of the ammoniacal liquors is somewhat reduced; but, on the other hand, loss of ammonia, resulting from the circulation and heating of the liquor, is avoided.

In the further passage of the tar from the hydraulic mains to the works' tank, a reservoir (shown in fig. 3) had previously been employed, serving as a hydraulic seal. This arrangement pro-

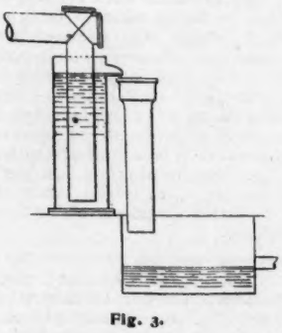


Fig. 3.

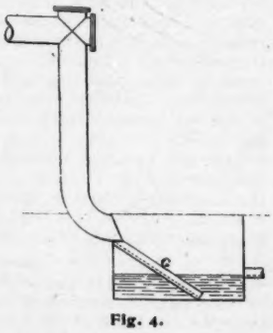


Fig. 4.

vided a means of almost perfect emulsification of water and tar, but was used on account of the absence of sealed tar outlets in the hydraulic mains. It has been displaced by the arrangement shown in fig. 4.

The tars are conveyed from the works' tank to that in which they are finally stored by a wrought-iron cylindrical vessel which can be exhausted by a pump. Such an arrangement (shown in fig. 5) possesses the advantage of requiring only a relatively small length of pipe, which serves alternately for providing the exhaust pressure and permitting the flow of the tar. But it, again, was found to favour the intimate mixture of tar and water, as the two liquids pass together to the storage tank. This was remedied by adopting the type of delivery pipe shown in fig. 6.

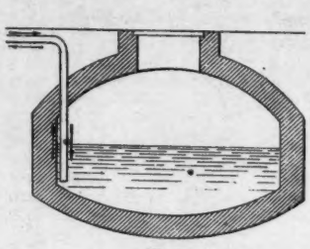


Fig. 5.

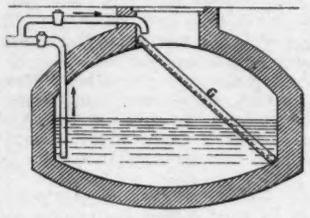


Fig. 6.

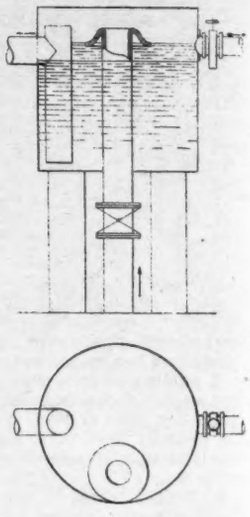


Fig. 7.

In the modification of these methods, the aim has been to avoid the flow of tar from any height into a tank containing a mixture of tar and water and thus having invariably a layer of water on the upper surface. By causing the tar to flow as a thin layer down an inclined plane, the separation of the globules of water contained in it can easily take place to such an extent that they are absorbed by the upper layer of water, while the tar continues its descending course. This type of "dripper," made of wood, and placed at an angle of 45°, is shown at G in figs. 4 and 6.

For the further dehydration of tar a separator such as that shown in fig. 7 has been used. As a result of these modifications, tars delivered at the present time average about 5 p.ct. of water, and thus evidence the success which has followed the combined measures to remove opportunities for intimate mixture of tar and water in the passage of the two from the hydraulic main to the tank.

British Engineers' Association Directory.—A copy has been received of the "Official Directory of Members" of the British Engineers' Association (Incorporated), of No. 32, Victoria Street, S.W. It is in three languages—English, French, and Russian; and the Secretary of the Association (Mr. H. R. Summers) intimates that applications for copies are invited from consulting and managing engineers, municipal engineers, and other important users of engineering plant and materials both at home and overseas. It may be pointed out that the object of the Association is to provide a central national organization in the engineering industry for the promotion of the interests of the British manufacturing engineers and of British engineering. No firm which is under foreign influence, and no merchant or other intermediary, whether British or otherwise, can be a member of the Association, the aggregate capital of whose members (employed by them in their respective businesses) amounts to over £130,000,000. Anyone wishing to buy British engineering plant or machinery can be certain that he is doing so by purchasing from a member of the Association whose name appears in the Directory—which will thus be found to serve a highly useful purpose.

Transmission of Coke-Oven Gas in Silesia.—Since 1911, says "Engineering," coke-oven gas has been supplied from the coking plant near the Julius Colliery to Waldenburg and other places in Silesia; and of late transmission and distribution lines have been considerably extended. Two short lines, each about two miles long, start from the colliery—one to Waldenburg, and the other to the gasholder and general gas-meter stations at Altwasser. The soil on the latter line is so much subjected to subsidences that it was not considered advisable to bury that section of the line in the ground. Staging was first considered; but finally the line was laid in the ground. The line consists of steel pipe sections; and in the endangered ground the ends of the sections (Mannesmann pipes in this part) were fitted into curved sleeves. In some cases the pipe was pulled some way out of its sleeve; but the supply of gas was only in one case interrupted for more than three hours. The gas losses in the pipe system range from 2 to 8 p.ct. In the gasholder the pressure is high; but in the distributing pipes it is 175, 150, or 80 mm. The coke-oven gas having a higher density than the coal gas formerly used for illumination, the gas pressure had to be adapted to the burners. The gas supply had, by 1916, increased to 5,000,000 c.m. a year, but the industrial use of gas in large works was only then developing.

THE OXY-COAL GAS-FLAME.

At the Royal Society of Arts on Monday, Jan. 21, Mr. J. R. Darling delivered the first of a series of three Cantor lectures on high-temperature processes and products. The lecture was devoted to a description of the various methods of obtaining high temperature—viz., the burning of coal gas in air, the oxy-hydrogen flame, the oxy-acetylene flame, and the electric furnace. Incidentally the lecturer supported a suggestion made some time since by Sir Robert Hadfield, that a research should be undertaken to ascertain the possibilities in the burning of gas under high pressure. Many years ago Sir Henry Bessemer had obtained promising results by exploding the compressed charge in a gas-engine—a temperature of 2000° C. being measured.

Speaking of the oxy-hydrogen flame in connection with autogenous welding, Mr. Darling said that an oxy-coal gas-flame might be used with advantage but for the drawback that coal gas contained certain impurities which might have a detrimental effect upon the work upon which the flame impinged. Therefore, whenever there was any danger of damage to the work owing to the impurities in coal gas, hydrogen was used in preference. Very good work, however, could be done by coal gas; and the probability was that the oxy-coal gas-flame would be used more in the future than in the past. Fairly successful results could be obtained in the welding of cast iron with the oxy-coal gas flame, although it needed considerable care on the part of the operator. The temperature obtainable was, approximately, that of the oxy-hydrogen flame.

On the general question of obtaining high temperature, Mr. Darling said we must tackle the problem of seeing how, by burning fuel in air, higher temperatures could be obtained than were at present possible by this method. There was plenty of scope for development in this direction, although there were a great many difficulties in the way.

ESTIMATION OF MAINLAYING COSTS.

While a cost chart of standard practical costs of mainlaying applicable anywhere regardless of local conditions and circumstances, is impracticable in entirety, Mr. George Wehrle, of the Denver Gas and Electric Light Company, writing to the New York "Gas Age," shows that many details are of a fixed character. Costs of labour and material, nature of soil, and wage rates may vary in every case; but the quantity of soil moved per foot run, labour, and lead used for jointing, and other factors, are constant for each size and description of pipe; and he has been able to draw up a scheme of unit figures, that renders the work of preparing estimates a comparatively simple and easy matter, based upon his own experience.

EXCAVATION.

Under average conditions, one man can open-up and back-fill 9 c.ft. of soil per working hour; and on this basis, he works out the cost in terms of "cent-hours" per foot-run of standard size trench per foot depth, exclusive of joint-holes, for pipes ranging from 4 to 30 in. diameter. The average rate of wage and length and depth of trench being known, a simple calculation gives the cost of any extent of work. Reckoning a clear space of 8 in. all round the pipe, over 18 in. linear, he obtains a formula for figuring out the cost of joint-holes for any size of pipe:—

(1) $[2 \times 8 \times 18 \times (\text{diameter of pipe} + 16) + 8 \times 18 \times (\text{standard width of trench})] \div 12 = \text{cubic content of joint-hole per foot-run of trench.}$ (12 ft. pipes.)

(2) When A = unit cost, B = depth of trench in feet, C = unit cost of joint-holes (I), and D = labour cost in "cent-hours," the cost of trenching and back-filling in "cent-hours" is—

$$2\ (A \times B + C)\ D.$$

This can be applied to screwed steel pipe by omitting the joint-holes. Corrections for special quality of soil, or for extra expenses—such as paving or shoring—can be treated as an extra.

LAYING.

Labour involved in laying cast-iron pipe includes handling from curb line to trench, inspection, swabbing-out, and lowering, and, with steel pipe, the reversing of couplings in addition. It is arrived at by establishing the lineal feet of pipe handled in unit time, by a foreman and number of men usual for each size of pipe, based on standard weights. Pipes under 12 in. diameter are assumed to be lowered by hand, and above this size by portable derrick. The weight handled per hour is taken as 425 lbs. irrespective of the size of pipe; and the number of men, multiplied by this figure, divided by the standard foot weight, gives the lineal feet that can be laid per hour in "cent-hours."

JOINTING.

Following similar lines, but substituting pounds of lead per joint for weight of pipe, he arrives at a unit jointing cost per lineal foot. The weight of lead was taken as 12½ lbs. per man-hour. Caulkers, yarners, and lead men are all concerned; but as a rule the local wage rate for the first may be used, the difference in rates between the three being so slight as to be negligible in practice. As applied to screwed pipe, the work per man-hour varies with the diameter.

COST OF MATERIAL.

On similar lines, the cost of cast-iron pipe is charted at $1 per ton, reduced to foot-run; and steel pipe at 1 c. per foot, with lead and yarn each at 1 c. per pound. Fittings and specials must be estimated separately as extras.

Maintenance of store, checking, unloading, &c., is put at 4 p.ct., and supervision, engineering, and contingencies—such as general foremen, watchmen, odd helpers, preliminary surveying and levelling, permits, &c.—at 10 p.ct. on the total cost price. Though some of this may be covered in other items, it is a wise policy to include the entire 10 p.ct. as a safety factor.

Tables illustrating the above methods, as applied to cast-iron pipe of various sizes, and also to steel pipe, are included, together with summaries of unit costs.

ESTIMATION OF TAR-FOG IN GAS.

The following short report is taken from the "Journal of the Society of Chemical Industry" of a paper read before the Yorkshire Section (under the Chairmanship of Prof. J. W. Cobb), on the 17th ult., by Mr. Alfred Edwards, of the Leeds Corporation Gas Department, entitled the "Approximate Estimation of Tar-Fog in Gas."

Before reading his paper, Mr. Edwards mentioned that gas was generally produced now with a carbonizing temperature in the retort of something like 900° C. He indicated its course through the different pieces of apparatus. By the time it had passed the exhauster, the tar carried by the gas was in a very impalpable state, like fog; and it was this fog which caused difficulty to the gas engineer and coke-oven man, and even to men concerned with the making of power gas.

At the appropriate points in the reading of the paper the author exhibited specimens of tar-fog collected on filter-paper, and he demonstrated the use of the density meter of Messrs. Sanger, Shepherd, & Co., in which the stains are balanced by a neutral-tinted wedge graduated in Hurter and Driffield units. The value of the method lies in the comparative results it gives; the absolute figures being only approximate.

The Chairman endorsed the author's remarks concerning the difficulty of directly obtaining a satisfactory sample of tar-fog. There was, he thought, an element of uncertainty in the method arising from the physical properties of the fog, from the likelihood of superposition of deposits on the filter-paper, or from possible condensation upon the metal apparatus. Mr. J. Miller suggested the substitution of a cake of naphthalene for the filter-paper in the sampling process, which could be afterwards dissolved with the collected tar for the density test—a suggestion subsequently approved by Prof. Cobb as likely to put the method on a sound basis.

In replying upon the discussion, Mr. Edwards said that all his experiments had been made with cold gas—*i.e.*, with gas not more than 20° or 30° above air temperature—but he intended, if possible, to make further experiments with hot gas. With reference to the superposition of tar particles on the filter-paper in relation to the results from tar suspended in liquid in a cell, this was the whole *crux* of the question; and he had not been able to satisfy himself upon it. He thought the Lovibond tintometer was fairly suitable for work of this kind, but not so handy as the density meter. He was much obliged to Mr. Miller for the suggestion as to the use of naphthalene instead of filter-paper, which was very good if it could be well worked out.

Show-Room Decoration and Equipment.

Readers will recall the illustrated description given some time ago in the "JOURNAL" of the new show-rooms of the Derby Gas Light and Coke Company, for the entire scheme of which the Nautilus Fire Company, Ltd. (now owned by the Davis Gas-Stove Company), were responsible—they having designed, planned, and executed it. What has been accomplished at Derby will prove conclusively to visitors how attractive a gas show-room may be made. Those, however, who are unable to go to Derby and see for themselves just what has been done, may get a good idea of the artistic excellence and practical value of the Nautilus Company's decorative work, by a study of a portfolio of large photographic views illustrating six aspects of the show-rooms, which has been prepared by the firm, who have, of course, made a special study of gas show-room decoration and equipment.

Physics of the Welsbach Mantle.—A joint meeting of the Franklin Institute, the Physics Club of Philadelphia, and the American Illuminating Engineering Society was held on the 10th inst., in Philadelphia, when Dr. Herbert E. Ives, the Physicist of the United Gas Improvement Company, delivered a lecture dealing with the nature of radiation, with special reference to selective temperature radiation. The radiation from various oxides and oxide mixtures was discussed in detail, and the behaviour of the ordinary gas-mantle elucidated. The lecture was illustrated by experiments and lantern slides; while the Welsbach Company furnished an exhibition illustrating the manufacture of mantles.

REGISTER OF PATENTS.

Retort.—No. 111,871.

BOSTAPH, H. P., and the BOSTAPH ENGINEERING COMPANY, of Detroit, Mich., U.S.A.

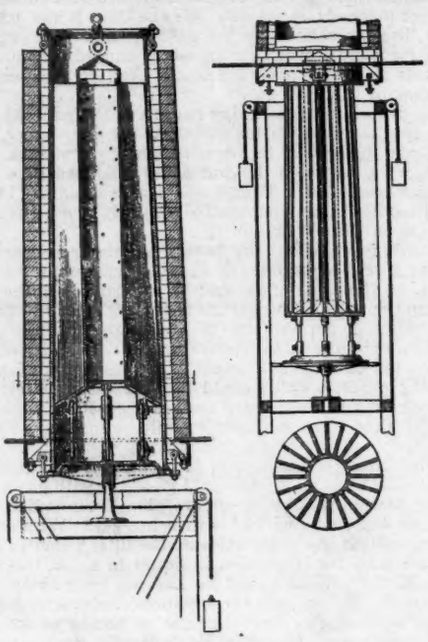
No. 15,477; Oct. 30, 1916.

This invention has for its object to provide a retort wherein the coal is converted into coke capable of burning with a long smokeless flame, and whereby the volatile matter driven off during the coking operation and recoverable is "of increased quantity and of superior quality."

The retort is so constructed as to contain the coal to be treated in relatively narrow columns, so arranged that heat applied to the exterior acts on each column of coal along one long edge and progressively toward the other long edge, with the gases of distillation escaping along the long edge remote from that to which the heat is initially applied—such escape being facilitated by the production of subatmospheric pressure conditions.

For commercial reasons, the retort is so constructed as to include a series of thin columns of coal grouped about a central duct into which the gases of distillation pass, and from which they are withdrawn. The columns are separated by division walls extending from the central duct to the outer shell of the retort—thus "providing heat-conducting means of greater permeability to heat than the columns of coal."

The retort is customarily made of columnar-form, with a central longitudinal duct and radial division walls extending from it to the shell of the retort, whereby the coal columns are of segmental cross-section of greater radial depth than circumferential width, and each column communicates with the central duct along the inner long edge.



Bostaph's Retort.

The retort has the central duct and the webs constituting a removable core for the shell of the retort, whereby the core may be lowered from the retort to discharge the coke and at the same time sufficiently chill the core that when again introduced into the retort and the latter is charged with coal, the temperature to which the coal is initially subjected is considerably lower than that to which the retort is constantly subjected; so that the coal is treated progressively by heat conducted from the outer edges of the coal columns toward the inner edges, because of the heat conductivity of the division walls. The separate core facilitates the discharge of the coked contents of the retort; this discharge being further facilitated by the initial cooling due to the introduction of steam into the retort.

The invention will be best understood from an examination of the accompanying illustration—a longitudinal vertical section of the retort; an elevation, partially in section, showing the bottom end of the retort and the core lowered therefrom, as well as some portions of the core lowering and lifting means; and a cross-section of the core.

Controlling the Gas Supply to Water-Heaters. No. 111,879.

LOWE, J., of Auckland, New Zealand.

No. 17,608; Dec. 7, 1916.

This control device is of the type operated by the flow of water through either the water inlet or outlet pipe of the heater—such flow of water being caused by turning on any of the draw-off cocks on the water outlet pipe or hot-water system with which the heater may be connected, or by opening a control cock on the water inlet pipe.

The gas-valve contains a pair of plungers, of unequal area, arranged the one to oppose the motion of the other, and against one side only of each of which, or against one side of each of flexible diaphragms in contact with, or bearing against, the plungers, differential and equal water pressures are directed to actuate the mechanism controlling the gas passage through the gas-valve. When the water pressures act on the plungers direct, the latter are provided with cup leathers or packing to prevent any leakage; but it is preferred to employ the flexible diaphragms for this purpose, in order that the plungers can be fitted freely, and thus respond to, or be actuated by, the slightest variation, or cessation of variation, in the water pressures transmitted to the gas-valve.

In this form of gas-valve the differential pressures cause the valve to be opened, and the equal pressures cause it to be closed—there being no necessity to employ springs or any other assistance in either operation; while stuffing boxes are not used.

Prismatic Glassware for Illuminating Purposes. No. 111,986.

HOLOPHANE GLASS COMPANY, of New York.

No. 10,767; July 26, 1917.

This invention relates to compound prismatic glass fittings for illuminating purposes—that is to say, a fitting comprised of two layers of glass having light directing prisms on one or both surfaces facing each other between the layers. They are formed of two layers of glass over a portion of their surface only (which direct or deflect the rays of light), while the remaining parts are of one layer only. In a convenient form one of the two layers is of blown glass and the other is of pressed prismatic glass. The effect is said to be that "the weight and cost of the fittings are both decreased, while their illumination efficiency is greater to a certain extent than that of some types of previous compound fittings."

Separating Gases and Forming Products thereby. No. 112,153.

MOND, A.; a communication from BRADLEY, L., of East Orange, New Jersey, and SCHMIDT, W. A., of Los Angeles, California.

No. 18,303; Dec. 21, 1916.

This invention relates to apparatus for removing certain gaseous constituents from a mixture of gases; the main object being to provide for such operation where the gas to be removed is not readily separable by condensation. It consists essentially in distributing into the gases to be treated a solid pulverulent substance, which is capable of reacting chemically with, or acting physically upon, the constituents to be separated from the gases in such manner as to form a cloud, mist, or fume of suspended particles, and in then removing the suspended particles from the remainder of the gas by passing an electric discharge through a current of the gases containing the cloud or mist.

The purpose of the invention is to bring the absorbent material quickly into intimate contact with the gases under treatment and to continually renew it so that the absorption takes place with maximum rapidity and effectiveness. The method is applicable to a wide range of industrial and chemical processes; and "while it depends fundamentally on the utilization of a cloud or mist of solid or liquid particles in the gas under treatment, this cloud or mist may be formed in various ways according to the special conditions of the problem." It may be formed by spraying, forcing, or blowing the solid particles into the gases or otherwise; and any suitable apparatus may be used in carrying out the method.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 23.]

Nos. 766—1138.

ABRAHAMS, E. G.—"Generation of gas for automobiles." No. 795.

DAVIDSON, W. B.—"Apparatus for bringing liquids and gases, vapours, fumes, &c., into intimate contact." No. 1025.

HANDS, G.—"Inverted incandescent burners." No. 1138.

HANFF, E.—"Repairing burst or fractured pipes." No. 921.

HOLMES & Co., W. C.—See Davidson. No. 1025.

KEMP, J. R.—"Rotary pump or meter." No. 1074.

LUCAS, O. D.—"Retorting systems for distilling coal, shales, &c." No. 806.

LYON GAS EQUIPMENT, LTD., E.—"Gas-mixing chambers." No. 927.

LYON GAS EQUIPMENT, LTD., E.—"Valves." No. 928.

M'NEILL, J.—"Gas heating-appliances, &c." No. 1135.

MAINA, J.—See Lyon. Nos. 927, 928.

MORGAN, H.—"Gas-containers." No. 848.

PALMER, T. C.—See Lucas. No. 806.

PARKER, J. W.—See Abrahams. No. 795.

PEASE, E. L.—"Extraction of ammonia from gases and vapours, and production of nitrogen compounds." No. 1053.

PERESS, J. S.—"Gas-bags." No. 1128.

RAYBOULD, A.—See Hands. No. 1138.

RITCHIE, D. W.—"Apparatus for storage and transference of gas." No. 859.

SMITH, E. W.—"Mobile gas engines and generators." No. 955.

SOC. D'EXPLOITATION DES APPAREILS RATEAU.—"Apparatus for production of water gas." No. 1114.

TELEPHOS DOMESTIC AND STREET LIGHTING COMPANY.—"Operating electric switches from a distance." No. 855.

WILD, J. E.—"Flexible gas-containers." No. 879.

WINDLE, E. A.—"Gas-stoves." No. 769.

Gas-Workers' Wages at Arbroath.—The Arbroath Gas Committee have reported to the Council that it has been agreed to increase the wages of the boilermen, gas-fitters, hoistman, pipe-layers, and general labourers at the gas-works who are members of the Workers' Union, by 1s. per week over the amount paid in August, 1914, on condition that no further application on their behalf is to be made for an increase of wages before May 1 next.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The "Financial Hardships" Bills.

Referring to procedure in connection with the Sliding-Scale Revision Bills, the "Morning Post" says the subject was discussed last week, when the Chairmen of Committees of the two Houses met to consider the order in which the Bills shall be introduced. It is suggested that, so far as the principle of increase is concerned, the various promoters shall act in concert, and a Joint Committee of Lords and Commons be set up to consider and report on it.

A Gas Stoker's Release from Military Service.

Mr. CLOUGH asked whether the Under-Secretary of State for War was aware that the Earby and Thornton Gas Company were compelled, for the want of stokers, to restrict the supply of gas to daylight hours for the textile trades; and when Private J. E., No. 74,712, 2/1st Derbyshire Yeomanry, would be released from the Colours, as recommended to the War Office on Nov. 24 last.

Mr. MACPHERSON replied that orders for the man's release had been given. If he was willing to accept employment with the Company, he might be expected to start work at an early date.

Summer Time this Year.

The HOME SECRETARY announced in the House of Commons last Thursday that summer time will again come into operation this year. The question of the period during which it will operate is to be carefully considered. In view of the early date of the Easter Holidays, it was suggested by the Member who put the question that the period should be made from March 25 until the first week in October.

LEGAL INTELLIGENCE.

Prof. Armstrong and English Dye Companies.

An article by Prof. Armstrong in the "Evening Standard" and the "Manchester Evening Chronicle" resulted in libel actions being brought against him by the Clayton Aniline Company, Ltd., and the Society of Chemical Industry of Basle, who objected to statements made about Swiss and German interests, and about playing "into the hands of those whose interest it is to prevent our advance." When the actions were reached in Mr. Justice M'Cardie's Court last Thursday, Mr. Hogg, K.C., stated that they had been settled. There was no foundation whatever for the suggestions the defendant had made. The Clayton Aniline Company was an English Company who had since the war devoted the whole of their energies to work for the Government. They were satisfied that both Prof. Armstrong and the newspapers which had published the libel had acted in good faith; but the defendant now saw that he had been entirely misinformed, and had published an apology. He had also paid the whole of the plaintiffs' costs, and was prepared to repeat the apology in open Court. On these terms, the plaintiffs were willing that the record should be withdrawn. Sir Hugh Fraser, for the defendant, said he had acted in good faith, but was now satisfied that he had made a mistake, and wished to do all in his power to rectify it. He therefore repeated the apology which had already been published, and expressed his regret. His Lordship remarked that the plaintiffs had fully vindicated their position; and the defendant had acted with great fairness and propriety.

MISCELLANEOUS NEWS.

USE OF FLUELESS GAS-RADIATORS.

In the "Electricity Supply Memoranda" on Dec. 25, the "Correspondence" columns on Jan. 1, and a Communicated Article on Jan. 15, reference was made to remarks by Dr. F. J. Waldo, H.M. Coroner for the City of London and Southwark, on the subject of the use in the two Courts over which he presides of flueless gas-radiators. These statements were contained in his annual return for 1916 to the Lord Mayor and Corporation of London. In his report [*ante*, p. 27], Dr. Waldo alluded to analyses made by Mr. J. H. Coste and Dr. W. H. Hurtley; and we have now been favoured with the full text of the remarks of these gentlemen, which, in view of the interest that has been aroused, it will be well to place on record in the "JOURNAL."

PART III.—REPORT ON HEATING OF THE CORONER'S COURT AT SOUTHWARK.

Another report* made at my request by Dr. Hurtley places a different complexion on the matter. Its main essential fact is that it shows the presence of small quantities of carbon monoxide, a highly poisonous gas, which is a product of ordinary gas combustion,† and gives rise to headache, lung irritation, and other symptoms like those developed by myself and my co-workers after sitting in the Court.

* See Appendix G.

† "Hygiene and Public Health," by Parkes and Kenwood, 5th Ed. (1913), p. 178: When purified, coal gas contains, on an average: Hydrogen, 46 p.ct.; marsh gas, 37 p.ct.; carbon monoxide, 7 p.ct.; illuminants (ethylene, acetylene), 5 p.ct.; nitrogen, sulphurous acid, &c., 5 p.ct. The products of combustion of coal gas are carbonic acid, 50 to 60 p.ct.; water, 16 p.ct.; variable traces of carbon monoxide (least when combustion is most perfect) —sulphurous acid, and ammonia.

APPENDIX F.

Report on the Air of the Southwark Coroner's Court.

On Thursday, Dec. 14, I went to the Southwark Coroner's Court, as arranged with the Chief Officer of the Public Control Department, and there met the Assistant Borough Engineer.

The day was cold, and had been foggy. It was not clear at 11 a.m., when I arrived at the Court. On entering from the cold air, the room appeared to be pleasantly warm. It was heated by three "radiators," one on the dais or level against the left-hand wall, and the other two against the left and right hand walls near the barrier separating the general public from the body of the Court. These radiators were non-condensing and flueless; and it therefore appeared certain that the products of combustion escaped into the air of the Court. But, as the Engineer understood, they consumed their own products. I had an analysis of the issuing air made. The proportions of carbon dioxide and oxygen indicated that the air contained the products of combustion of upwards of 1-20th its volume of coal or similar gas. There was, therefore, no doubt that the products, both water and carbon dioxide, entered the room. It is probable that some of the small amount of sulphur trioxide produced was retained by the metal surfaces of the radiators, though a very slight smell of this substance was noticed in the issuing gases, but not in the air of the room.

Determinations of carbon dioxide and humidity made during a period of three hours in various parts of the room amply confirmed the presence of carbon dioxide and water vapour in large amounts. Towards the close of this period, some feeling of discomfort was noticed, but nothing which could be described as "oppression" or "stuffiness." The relatively low temperature—never as high as 58° Fahr.—may account in part for the absence of any such feeling.

It should be stated, on the one hand, that the weather conditions were not such as to promote active ventilation, and, on the other, that only three or four persons were ever present together in the large room, instead of the relatively large number found when the Court is sitting.

The results of analysis and humidity determinations, with a rough plan, are attached.

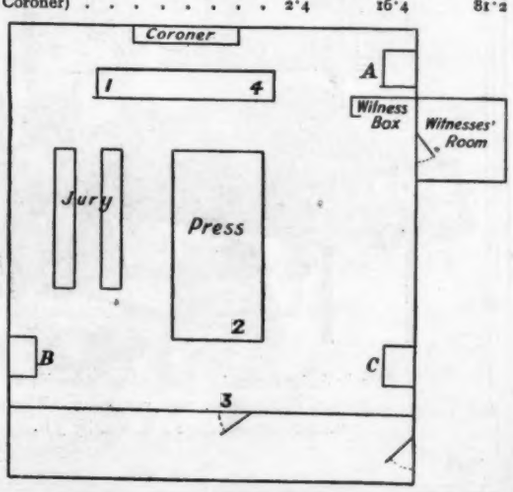
(Signed) J. H. COSTE,
Chemist to the London County Council.

Southwark Coroner's Court.—Examination of Air by Mr. J. H. Coste.

Time.	Position.	Carbon Dioxide.	Temp.	P.Ct. Humidity
11.30 a.m. to 12 noon	Coroner's table (right side). 1.	0·43, 0·52, 0·35 } 0·42 p.ct.	—	—
12 noon.			54·5	91
12.10 p.m.			54·8	90
12.20 ,,		—	55·3	89
12.40 ,,		—	55·2	92
12.2 p.m.	Press table (far end). 2.	0·29, 0·37, 0·27 } 0·31 p.ct.	54·2	90
12.10 ,,			54·5	89
1.5 p.m. to 1.15 p.m.				
2.23 p.m.	Partition at public part of court. 3.	0·305 p.ct	56·0	95
2·40 ,,			56·2	94
·20 ,,			—	—
·55 ,,			57·5	93
1.50 p.m.	Coroner's table (side nearer radiator). 4.	0·39 p.ct.	—	—

1.30 p.m., outside air, 0·05 p.ct. carbon dioxide.

Air Issuing from Radiator.	P.Ct.	Oxygen. P.Ct.	Nitrogen, &c P.Ct.
Lower end of Court B (right hand of Coroner)	3·2	13·6	83·2
Upper end of Court A (left hand of Coroner)	2·4	16·4	81·2

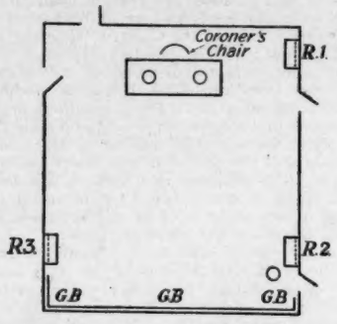


A, B, C, Radiators.
1, 2, 3, 4, Places where Examinations of Air were made.

APPENDIX G.

Report on the Air of the Coroner's Court at the Borough. Date of Visit to the Court, Tuesday, Dec. 19, 1916.

I arrived at the Court at 2.30 p.m. The heating had been started at 10.5 a.m., and the windows had been kept closed; but the two ventilators in the ceiling of the Court were open. The Court attendant told me that he had no control over them.



A hygrometer was placed on the table in front of the Coroner's chair; and two bottles were also placed there. These were allowed to stand there for one hour; the air being sucked out of the bottles periodically, so as to ensure their being filled with a typical sample of the air at that part of the Court. A third bottle was placed to receive the heated air issuing from the Radiator R 2. The samples of air collected were examined in my laboratory.

OBSERVATIONS AND RESULTS.

Temperature and Hygrometric State of the Air.—Though the radiators had been in operation over four hours before my arrival, and for five-and-a-half hours by the time I left the Court, the temperature with doors and windows closed—a door being opened occasionally—was only 52° Fahr. For a room in which a man has to sit still for three or four hours, such a temperature is far too low.

When the dry bulb was at 52° Fahr., the wet bulb was at 51·6° Fahr. This difference corresponds to 97 p.ct. saturation with water vapour. This degree of humidity is far too high; 66 p.ct. is quite sufficiently high. The cause of this excessive humidity is the combustion of the coal gas. Results of this excessive humidity were seen—

(*a*).—On a water-bottle standing on the table in the centre of the room. This was dripping with water.

(*b*).—On the distempered parts of the walls above the oak panelling. These walls were evidently loaded with water.

(*c*).—On the green bricks at the far end of the Court, marked G B in the diagram. These were streaming with water, which was beginning to trickle on the floor before I left.

Carbon Dioxide.—The carbon dioxide in the air escaping from Radiator No. 2 in the diagram was 187 parts in 10,000. The carbon dioxide at the Coroner's table was 29·9 parts in 10,000. The normal figure for town air is 4 parts in 10,000.

Carbon Monoxide.—A qualitative test performed on 103 c.c. of air from Radiator No. 2 showed a minute, but unmistakeable, trace of this poisonous gas. The test employed was the blood test. The above amount of air shaken up with two drops of blood in 10 c.c. of water behaved thus:

(*a*).—It showed the characteristic pink colour.

(*b*).—On addition of a reducing agent, the pink colour and the characteristic carboxyhæmoglobin spectrum remained.

I tried to estimate the amount of this gas in Haldane's apparatus; but the small amount of the gas makes the result very doubtful. However, two concordant results gave about 0·05 p.ct.

I could not detect the gas in the air collected at the Coroner's table; the dilution was too great. Of its presence in the gas escaping from the radiator, I am absolutely certain.

Sulphur Dioxide.—Coal gas always contains small quantities of sulphur compounds, and such compounds, when burnt, produce sulphur dioxide. A qualitative test on the gas collected from Radiator No. 2 showed that it contained a trace of sulphur dioxide. The amount was so small that I could not estimate it in the sample I was able to bring away. I could not prove its presence in the air collected at the Coroner's table. No doubt owing to the great solubility of this gas in water, it was largely absorbed by the abundance of water deposited on the walls of the room.

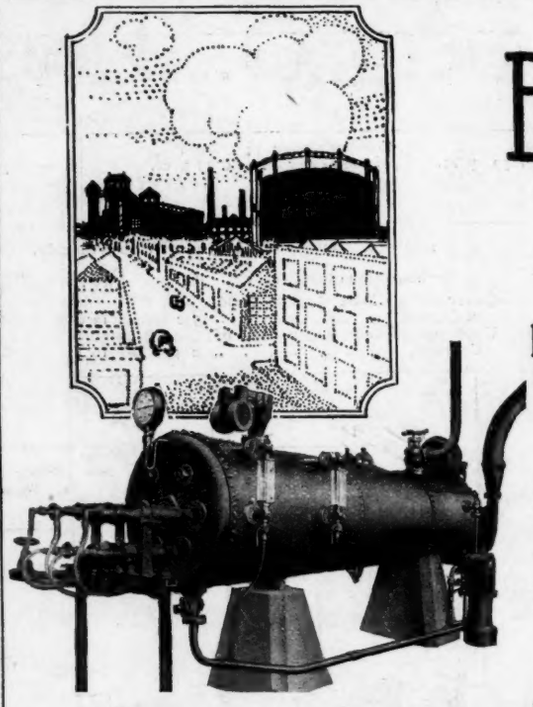
Effect of the Air on Myself.—Immediately on entering the room, I noticed the peculiar smell due to the products of combustion of coal gas. I remained in the room about an hour-and-a-quarter; and during this time, I experienced nothing more than a vague sensation of slight discomfort, and a slight flushing of the face. But a short time after leaving the room, I experienced a headache exactly similar to the headache produced on me after voluntarily entering an experimental chamber containing a small percentage of carbon monoxide. On that occasion the headache came on after leaving the experimental chamber.

As regards the temperature, I wore a thick overcoat, and walked about constantly, and so did not feel the cold. To have sat still in ordinary indoor clothing would have been a severe trial.

CONCLUSIONS.

The heating arrangements of the Coroner's Court, Borough—

(1) *Are inadequate.* On a cold day, it cannot raise the temperature above 52° Fahr. Such a temperature cannot be endured in comfort



Early delivery can be given or all sizes from 250-1500 lbs. evapor. cap. per hour. The smallest size measures 2 ft. dia. by 5 ft.

BONECOURT
Gas fired
BOILER

has a Thermal Efficiency of 92·7%

THE "BONECOURT" is far more efficient than other boilers fired with town gas, for whereas the latter often consume 5 c. ft. for every 1 lb. steam evaporated at 212°F., the hourly consumption with the "BONECOURT" is about 2 c. ft. This rapid steaming boiler requires neither brick-setting nor chimney. It can be installed on any rigid floor: in a cellar, or on a top storey.

A further advantage is that female or other unskilled labour can give the slight attention required.

The principle on which the "BONECOURT" Boiler is based is fully explained in a handsome book which we will send you on request.

Bonecourt Waste Heat Boiler Co Ltd
PARLIAMENT MANSIONS, VICTORIA STREET, LONDON, S.W. 1.

by people sitting still. A temperature of 65° or 66° Fahr. is required by people of middle age or above it.

(2) *Are positively harmful.* Into the air of that small room there are sent the products of combustion from 22 powerful bunsen burners. Even if the combustion is perfectly complete, we see that the air is being loaded with carbon dioxide and saturated with water vapour, and is also being contaminated to a small extent by sulphur dioxide. It is now generally recognized that to breathe air practically saturated with aqueous vapour is always injurious. Carbon dioxide is not in itself injurious in the amount found in the room. Sulphur dioxide is injurious, and its presence should not be tolerated. Carbon monoxide is excessively poisonous; and no risk, even the remotest, should be run of introducing such a gas into the atmosphere of a room.

To conclude—The method adopted of warming the Coroner's Court at the Borough is absolutely wrong in principle. The warming ought to be effected by radiant heat, as by hot-water pipes, and not pouring the overheated products of the combustion of 22 bunsen burners into the room.

I have said nothing about the diminution of oxygen brought about by such a method; but even this is unimportant compared with the other matters to which I have drawn attention.

(Signed) W. H. HURTLEY.

Lecturer on Chemistry, St. Bartholomew's Hospital.

FUEL ECONOMY IN COOKING APPLIANCES.

The first of a course of three public lectures on the "Principles of Fuel Economy in the Design and Use of Cooking Appliances," by Mr. A. H. Barker, B.A., B.Sc., was delivered on Wednesday last, at University College, London, W.C.

The lecturer began by drawing attention to the immense inportance of the question of fuel economy, and to the great waste that is now taking place. He expressed the opinion that, of the total fuel bill, it might not be too much to say that three-quarters was wasted from one cause or another. A small proportion of the present consumption might be made to meet all requirements; and he wanted them to consider how far, and in what way, economy could be secured in the use of fuel for cooking. In the case of almost all apparatus designed to utilize heat, the better the facilities for securing economy by careful use, the greater were the facilities for waste through carelessness. Economy should, of course, be one of the prime factors in design and selection of cooking-ranges, &c.; but the person who had to pay for the fuel was in only a comparatively few cases the person who owned the stove. The matter was made worse by the fact that gas and electric cooking stoves were very seldom the property of the owner or occupier of the house in which they were fixed, but were hired out at a low rate. It was evident that, in the case of any large supply undertaking, the value of the apparatus on hire would run, in course of time, to many thousands of pounds; and should any improvements take place, the result would be, not only to reduce the consumption of gas or electricity, but to throw out of use a large amount of plant the scrapping of which would be reflected in the accounts. At the same time, many of these companies were among the most enlightened and progressive bodies in the country; and, even though against their apparent interests, they did a great deal to encourage economy. But it was clear that incentives to economy were to a large extent absent. Manufacturers naturally made what they could sell; and the only way to fully meet the matter would be by direct Government action. In all practical cooking appliances, there were many avenues through which heat could escape. These should be closed as far as possible, so that the utmost amount of heat might be concentrated on the food to be cooked. In other words, if they were to obtain the highest efficiency, it was necessary to reduce the escape of heat by every means in their power.

Taking gas, electricity, and coal, the gross cost of heat obtained directly from solid fuel was unquestionably the cheapest; but its use involved far more labour than either of the other forms, and it was less under control. The use of gas as at present employed also involved a tremendous waste of heat. It was convenient, and under control; but it involved the supply of air to the burning gas and the removal to the air of the products of combustion, with the attendant waste, both of which were grave disadvantages. With the use of electricity, there was no apparent need for the waste following on the introduction of fresh air; but there was great waste in generating the current. It was, however, easy to control, with an exactitude unobtainable by any other means. He was not at present concerned with considering the comparative waste of food. While the amount of heat obtainable from a pennyworth of coal was vastly greater than from gas or electricity, the question he wished to consider was not that of cheapness, but how to use the fuel with the least waste. With the ordinary coal-range, about 97 p.ct. of the heat was wasted, and 3 p.ct. was used. The result would depend a great deal upon the management of the cooking apparatus. He quoted the following gross figures of the destruction of coal involved in the supply of heat: 1000 B.Th.U. delivered into the kitchen as coal involves the destruction of approximately 0·071 lb. of coal, with no other products obtained; as gas, 0·493 lb., with other products obtained; as electricity, 0·366 lb., with no other products obtained.

It would, of course, be necessary to lay down in definite terms what was meant by efficiency. It might be possible to make an apparatus so efficient from the scientific point of view that it would not be practical to use it. He suggested that every oven should be standardized as to size, according to the weight of the joint of meat supposed to be its maximum capacity; and he proceeded to indicate methods of testing for ascertaining the efficiency of the ovens. In the course of his remarks, Mr. Barker said that 7·5 p.ct. might be regarded as the effi-

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ciency of some gas-ovens. Many were better than this; but he believed (though he was giving these figures without prejudice) that 20 p.ct. was the extreme limit. Efficiency results would very often be better, but for the fact that cooks would not turn out the gas before the cooking was done, so as to utilize the residual heat.

In the subsequent discussion, it was pointed out that the lecturer in discussing the determination of efficiency had referred to three ratios—obtaining heat, maintaining heat, and rate of cooling. Another factor was suggested as being necessary to indicate the advantage of a good solid oven in the matter of wear and tear. Mr. E. W. L. Nicol referring to the statement that in a coal-range only 3 p.ct. of the total heat available was used, said this would depend on the kind of coal the lecturer had in mind. He pointed out that gas coke was equally a domestic fuel, and very often contained less than 1 p.ct. of volatile matter. It would be interesting to determine the relative efficiency of solid fuels.

GAS SUPPLY IN THE TOTTENHAM DISTRICT.

The Council and the Company have a Conference with the Board of Trade,

At the last meeting of the Tottenham Urban District Council, it was reported that the Council had written to the Board of Trade requesting the Board to hold a local inquiry in regard to the affairs of the Tottenham District Light, Heat, and Power Company, "in view of the present appalling supply of gas to residents in Tottenham." The letter stated that for many months past the Company have failed to afford an adequate supply; but notwithstanding the representations of the Council, and innumerable complaints which have been made by consumers, no improvement has eventuated. The Council were strongly of opinion that the time has arrived when the Board of Trade should intervene for the purpose of safeguarding the interests of the consumers.

The Board sent a letter of acknowledgment; but the Council dispatched a telegram urging them to take immediate action, having regard to the continued unsatisfactory supply. To this, the Board replied by inviting representatives of the Council to a conference, which took place last Tuesday.

At the meeting of the Council on the evening of that day, Mr. Philip Buck, J.P. (the Chairman), said it was understood that the proceedings at the conference should, generally speaking, be regarded as private. He might say, however, that they had a promise from the Board that, after consultation with other Government Departments and their relations with the Gas Company, they would make a communication to the Council, which they trusted would be satisfactory. Unless the results were satisfactory, the Council would proceed further, and press the Government to grant a full inquiry.

THREATENED GAS-WORKS STRIKE AT NEWPORT (MON.)

There has been trouble at Newport (Mon.) with the Gas Company's employees, who handed in notices to cease work last Friday morning, if demands made by them in the matter of wages were not conceded. Alderman Thomas Canning (the Engineer of the Company) met the men on Wednesday afternoon, and placed before them the seriousness of the position from the national and local points of view; but the men insisted on their demands, which arose from dissatisfaction with an award issued on the 8th inst. by the Chief Industrial Commissioner's Department. Compared with other local awards, the men regarded the amount conceded to them (an average increase of 13s. 3d. a week above pre-war rates) as being unfair; and they unanimously resolved to reject it—formulating a demand which was subsequently modified to a request for an increase of £1 a week over pre-war rates. The threatened strike, it was reported, lacked the official sanction of the Union; the men acting entirely on their own responsibility.

The facts of the matter were clearly put by Alderman Canning in the subjoined letter, which appeared in the "South Wales Argus" last Thursday.

The Company have, either in bonus or wages, made the following advances to the working men in their employ:

March 5, 1915	3d. per shift
Feb. 4, 1916	2d. ,, ,,
July 21, 1916	5d. ,, ,,
March 23, 1917	5d. ,, ,,
Aug. 30, 1917	6d. ,, ,,
Total increase	1s. 9d. ,, ,,

The working men then asked, through their Union—the National Union of General Workers—that the question of a further advance in wages should be referred to arbitration; and to this the Company consented. The arbitration took place on the 2nd inst., and in an award dated Jan. 8, the Chief Industrial Commissioner's Department granted the working men of the Company an additional 4d. per shift, dating back to Dec. 5. The Company have accepted the award, and paid the workmen accordingly; but the workmen express themselves dissatisfied with the amount of the award, and have given in notice to cease work unless the whole of their demand of a wage of 20s. per week over and above pre-war rates is at once granted by the Company. In an undertaking where wages run high—such as that of the Newport Gas Company—this demand is one which financially it is impossible for the Company to meet. I may here observe that not even in London is such a bonus being paid to gas workers.

The present rates of wages paid to workmen over eighteen years of age in the employ of the Company vary from 6s. 4d. to 7s. 10d. per day. The total wages bill of the Company in 1913 (the year before the outbreak of war) was £16,555. In 1917, the same bill had mounted to £24,904, which, with the addition of the award, becomes £25,996. This is an advance of 57 p.ct. over the wages of 1913. The advance in the price of gas, which has to cover the enormously increased cost of coal and other materials as well as labour, has been only 37 p.ct.

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After this letter was written, a further offer was made to the workmen conceding them more than one-half of their new demand upon the Company.

Happily, at a well-attended meeting on Friday evening, the men decided, by a large majority, to accept the Company's offer and continue at work. It should be added that Mr. G. L. Scott, the local representative of the Ministry of Munitions, worked indefatigably, and that his efforts contributed to the establishment of peace.

OLDHAM CORPORATION GAS DEPARTMENT.

Coal—Coke—Wages—Naphthalene.

A variety of topics came up for discussion at the last meeting of the Oldham Gas Committee; Alderman H. Wilde, J.P., the Chairman, stating that their troubles with regard to coal supplies were by no means at an end. Mr. T. Duxbury, the Chief Engineer, said the coal stock was about 9000 tons, against 12,400 tons last year; the difference was 9000 tons in November. The loss during the last fortnight had been 3600 tons, so that at the rate of loss the department had about five weeks' supply. However, as they would soon be letting-down the retorts, the weekly loss would be reduced. An adjacent town, he added, had only ten days' supply.

It was reported that a letter had been received from the National Gas Council urging the necessity of gas-works undertakings not granting an increase of wages to workmen without making reference to the wages paid at gas-works in the neighbourhood. The letter was allowed to lie on the table, Alderman Wilde remarking that any increase they had made was in accordance with what had been given to the whole of the Corporation employees as war wages.

The accumulation of the stock of coke at the various works was also referred to. They had now 6500 tons in stock; but with the additional contracts which had been entered into (and the endeavours now being made to push sales), it was hoped to reduce the stock considerably. They were making more coke per 1000 c.ft. of gas carbonized than for some years past, entirely due to the fact that they had to use more coal.

Naphthalene troubles cropped up during a reference to the increasing sales of gas; Mr. Duxbury remarking that the increase would have been greater but for this factor.

Tyneside and the Sliding-Scale Proposals.—At a private conference of representatives of the various municipal bodies on Tyneside—presided over by the Lord Mayor of Newcastle (Sir George Lunn)—it was decided to oppose the sliding-scale modifications shortly to come before Parliament, particularly in regard to their bearing on the price of gas.

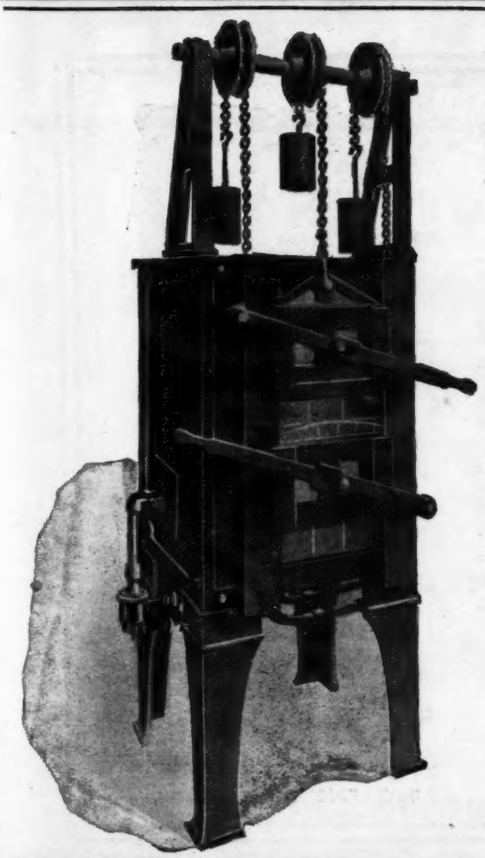
GAS FOR MOTOR VEHICLES.

At the Lancaster Police Court, last week, John Fletcher, a motor driver, of Morecambe, was fined 20s. for carrying an officer and his wife as passengers and running on petrol, though he had a gas-bag on his car. The defence was that he was using up the petrol in the tank, and had receipts to show that he had purchased 600 c.ft. of gas for the journey.

At the last meeting of the Heywood Town Council, it was decided that the following charges be made for filling gas-containers: 6d. per 100 c.ft., attendance included, with a minimum of 1s. for each filling; any quantity above 200 c.ft. to be at the rate of 3d. for every 50 c.ft., and time for filling.

The following remarks on "Long Hauls on Coal Gas" are taken from the current issue of the "Commercial Motor:" Now that coal gas has been departmentally accepted as a fuel for commercial vehicles for local transport, the problem of extending every inducement to permit long-distance haulage on this fuel should be taken energetically in hand. The various gas committees and societies of the country should discuss and thrash-out the question of wayside supplies with all speed. The interests elected by the gas-producing organizations to further the welfare of the industry surely are able to lay their heads together and evolve a comprehensive scheme covering all the main roads of the country. Unfortunately, despite the advances which have already been made, and the sustained fertility which is being displayed by inventors to enhance and popularize the use of this fuel, certain gas companies are disposed to regard the present movement as purely evanescent, and as a mere war-time expedient, to vanish instantly hostilities cease. We can assure them that they never made a bigger mistake. The coal-gas fuel movement has taken firm root among vehicle-users, and is certain to develop amazingly as the provision of facilities for charging increases. Coal-gas charging stations should be distributed at intervals of ten miles along all our trunk roads. Refilling stations should be as numerous as wayside garages for the supply of petrol. The greater the ease with which gas can be obtained, the heavier will become the demand for the fuel. The Government have admitted the claims of coal gas as a fuel for commercial purposes; and the Government must see that prejudice, shortsightedness, and mistaken hostility do not arrest or hinder development. Those gas companies—fortunately few in number—who decline to help the new movement, who take refuge behind legal niceties to escape a slender financial outlay on meters and connections which would speedily be recouped, should be confronted with compulsion. They are public supply companies which, by virtue of their monopoly to produce and distribute an indispensable commodity, with the right to open-up our roads, have incurred a distinct obligation to meet any reasonable demand which may arise for this article.

Referring to the new Board of Trade Order on the subject of gas-driven motor vehicles, "Motor Traction" says: Some disappointment,



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and perhaps not a little irritation, will be felt at the decision of the Board of Trade to apply to the use of coal gas as motor fuel restrictions similar to those applying to petrol and other liquid hydrocarbons. In any case, there will probably be a sharp division of opinion as to the necessity or wisdom of such a step. While those who feel that there is a tendency among the powers that be to make the present-day existence of the motor user as uncomfortable as possible may be labouring under a very human misapprehension, the placing of gas under control will inevitably tend both to give colour to their suspicion and to add somewhat to their numbers. Without agreeing or disagreeing with this body of opinion, it is permissible to express regret that officialdom has not seen its way to leave gas alone. Admitting to the full the essential seriousness of the petrol situation, it is not by any means certain that the new fuel regulations will do otherwise than hinder steps which large numbers of motor users would have taken on their own initiative to run their vans and lorries on gas, and to cease, temporarily at all events, being consumers of petrol. The fact that gas was a fuel which could be obtained without formality of any kind was in itself a strong inducement to give it a trial. This inducement is now taken away, and, not only that, the fuel consumer must now make a choice as between supplies of petrol and gas.

After carefully considering the matter of the standardization of gas-container filling-orifices, the Committee of the Motor Gas Equipment Association have decided that an orifice of 2 in. diameter is the most generally convenient; and this size has therefore been adopted as the standard. The Association have also arranged for the testing of fabrics (without charge to members) by a competent chemist and fabric expert.

By making inquiries, it has been ascertained by the "Commercial Motor" that there are only three places in the country where the undertakings will be unable to supply gas for traction purposes. These are Sheffield, Dudley, and Tottenham; and our contemporary remarks that it is gratifying to note the number is so small.

Some first-rate photographs of varied coal-gas equipments are reproduced in the January issue of "A Thousand-and-One Uses for Gas," which contains a special article on "Coal Gas for Motor Traction." Reference is made therein to the report on the subject published some time ago by the British Commercial Gas Association, as the result of a number of careful tests carried out by experts on their behalf; and a verbatim account is given of the debate at the annual meeting of the Association in October last.

The Petrol Control Department of the Board of Trade recently received a deputation from the Commercial Motor Users' Association, on the question of the new Gas Restriction Order, under which it is not possible for a gas permit and a petrol licence to be granted in respect of the same commercial motor vehicle. The deputation pointed out that, if it was the intention of the authorities, in framing the Order, to bring about a diminution in the use of petrol by imposing such a condition, this would not be the case. The result in practice would be to increase, and not to decrease, the amount of petrol used. Many commercial motor owners had gone to the trouble and expense of converting their vehicles to coal gas; and they only utilized the small quantity of petrol allowed them when it was not possible to re-fill their gas-containers, and on hills where the use of gas was sometimes unsatisfactory.

Mr. David Romain called the attention of the Corporation of the City of London, at their meeting last Thursday, to the Bills which are being promoted by several London Gas Companies in the ensuing session of Parliament, and urged the desirability of steps being taken to secure the setting-up in convenient centres in the Metropolis of stations where motors could be charged with gas. This, he said, was all the more necessary because of the scarcity of petrol, and of the suggestion that horses might have to be killed in order to supplement the meat supply of the community.

SUPERVISION OF EMPLOYEES' HEALTH.

Writing to the American "Gas Record," Mr. G. D. Grain, Jun., claims that industrial health supervision has been proved to increase the profit, both directly and indirectly, by development of *esprit de corps* and loyalty to the firm. It should not be confined to manual labour, but extended to office, outdoor, and all classes of employees. The physical examination of every applicant for employment is a desirable feature, as likely to reveal defects at present unknown, but a possible source of danger both to the individual and his fellow workers, or of incipient diseases that are of a more or less infectious character, but amenable to treatment which will prevent them from reaching the acute stage.

It has been observed that, to some extent, a physically imperfect man is less liable to accident than one without defects, because care is taken as to the adjustment of his occupation to his capabilities. While more likely to get hurt if passed without examination for any kind of employment, he is directed by the test towards suitable environments. Though it might be thought that accidents and health supervision have no direct relationship, the general effect is towards improvement of health, higher standards of personal hygiene, and to make slight ailments less frequent. A man in tip-top health condition is alert and more likely to recognize and avoid hazards; while one whose senses are dulled by depression is not so prompt to recognize danger and risks that are incidental to his employment. The routine accident report does not reveal the bodily defect that may have been the controlling factor. With the clerks and salesmen, the "way one feels" is not without influence; and a man in first-class condition will do more and better work. Large gas undertakings would find of advantage the circulation of bulletins on health and hygiene, as tending to bring about better conditions among those who at first sight may not be supposed to need them. The cost of medical service and supervision is comparatively slight, but, of course, varies according to the extent

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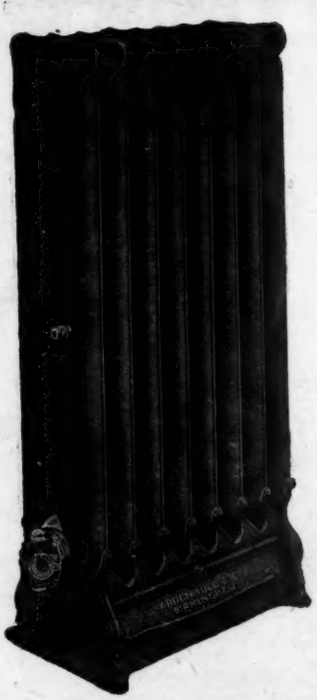

DOUBLE-COLUMN RADIATOR.

to which it is carried. The chief surgeon to the People's Gas Light and Coke Company of Chicago has found that the system is advantageous to both parties, as their interests are identical, and what helps the one benefits the other.

An accident prevention and health competition has recently been inaugurated by the Denver Gas and Electric Light Company, as a means of reducing accidents and maintaining the nearest practicable approach to full-time efficiency, which is important at present, when the staff is cut down to a minimum, and every hour of available labour is essential. The chief technologist has drawn up suggestions for the use of employees. There are thirteen departments, handicapped according to the nature of the work in such manner as to secure even conditions; and on May 1 the department showing the least loss of working time (not necessarily the lowest number of accidents) will receive a silver trophy cup, and a prize of £20 cash will be handed to the foreman. From that date, the award will be repeated every six months; and a department winning three times in succession will keep the cup.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 28.

The market for pitch maintains a firm tone, and there is no change to record in the price of the article. There is a good deal of inquiry, and shipments continue to be made. There is also a certain amount of inquiry for tar for road work. Naphtha remains steady at about 4s. 3d. to 4s. 6d. per gallon; all available supplies being readily taken up under Government licence. Anthracene, 48-50 p.ct., is worth 6d. per unit, casks included, at makers' works.

There is no change to report in the position of sulphate of ammonia.

Tar Products in the Provinces.

Jan. 28.

The average values for gas-works products during the week were: Gas-works coal tar, 27s. 6d. to 31s. 6d. Pitch, East Coast 20s. to 25s. per ton; West Coast—Manchester 18s. 6d. to 19s. 6d., Liverpool 19s. 6d. to 20s. 6d., Clyde 19s. 6d. to 20s. 6d., nominal. Benzol 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 3s. 10d. to 4s. Heavy naphtha, North, 2s. 3d. to 2s. 6d. Creosote, in bulk, North 4d. to 4¼d. Heavy oils, in bulk, North 4¼d. to 4½d. Carbolic acid, 60 p.ct. East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s. to 90s., bags included. Anthracene, "A" quality, 3d. per unit; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

The number of products now uncontrolled is so small that there is very little change in market conditions to record. In general, the position in pitch is improving. The London price remains unaltered, although export business tends to fall off on account of lack of shipping facilities. Only a small trade is passing on the North-East Coast at 30s. per ton; but in the Manchester district, there is a further slight improvement. Tar quotations are without change; and there is some talk of a fair quantity of prepared tar being set free for road purposes. Solvent naphtha is well maintained under the new conditions of licence, and so far there is no news that any application has been refused. Quotations are unaltered; and as long as there is no material advance from the present level, which is not considered unreasonable, it is thought that there will be no official interference in regard to price. Heavy naphtha, also, remains as last quoted. Naphthalenes are steady; the demand for lower grades of crude being a feature. Cresylic acid is steady at up to 3s. per gallon. Benzol, toluol, and carbolic acid are not much heard of, and creosote is being rapidly absorbed on Government account. The range of quotations is as follows:

Aniline Oil (pure): 1s. 2d. per lb.

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. 6d. per gallon; crystals 40% 1s. 3d. per lb.

Crude Tar: London 32s. to 35s., Midlands 26s. to 28s.; North 27s. to 28s. 6d. per ton, *ex* works.

Pitch: London 48s. to 50s. f.o.b.; East Coast, 22s. to 24s. f.o.b.; West Coast—Liverpool 22s.; Manchester 22s. to 23s. f.a.s.; Clyde 22s. to 24s.

Solvent Naphtha: Naked London 90-190% 3s. to 3s. 3d.; North 2s. 9d. to 3s. per gallon; 90-160% naked London 4s. 3d. to 4s. 6d.; North 4s. to 4s. 3d. per gallon.

Crude Naphtha: Naked 30% 8½d. to 8¼d.; North 6½d. to 6¼d.

Naphthalene: Refined £32 10s. to £35; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4½d.; North 3¾d.; heavy oil, 4¼d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 2s. 9d. to 2s. 10d. per gallon; 97-99%, 3s. per gallon, *ex* works London and f.o.b. other ports.

Grease Oils 180° Tw. (naked) £6 per ton f.o.r. makers' works.

In America interesting developments are taking place in connection with bye-product industry. Of the bye-product coke-oven plants completed and in operation up to the end of last year there were 7495, with an annual coal capacity of 35,625,000 tons, a total coke production of 26 million tons, 89,700 tons of ammonia, and 11,646,000 gallons of

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toluol. There are under contract for completion and operation this year 1844 ovens, with a carbonizing capacity of 10 million tons a year and a coke-making capacity of 7 million tons (approximately). If these plants can be operated to their full capacity, they should produce (say) 25,000 tons of ammonia and 3,500,000 gallons of toluol. The production of toluol will thus be brought up to 15 million gallons per annum. As before stated in these notes, the United States Government estimate their requirements of toluol at 22 million gallons—some 7 million gallons more than will be produced by all the bye-product coke-ovens in the country. This 7 million gallons is to be made up by further extensions for coal-tar recovery from the municipal gas plants.

Sulphate of Ammonia.

Very good orders for sulphate are coming along, and prospective buyers should place their demands at once—not only to secure early delivery, but to enable manufacturers to arrange for the suitable disposition of their outputs. The export trade is not worth considering—a trifling quantity was recently sent away at £50 per ton—and every week makes it clearer that this part of the trade is dead, except for special and particular cases for which official arrangements are made. At the moment, there is talk of shipment to the Canaries. The present home position is that there is no nitrate of soda available for agricultural purposes this year. The pre-war consumption was some 60,000 tons, and a similar quantity of sulphate. About 400,000 tons of sulphate are now being produced in this country, of which 250,000 tons are available for agricultural purposes. The home demand has so increased as to make even this greatly increased output barely sufficient. The position of the agriculturist is highly satisfactory; but that of the manufacturer is entirely different, as pointed out in these notes on several occasions, and it is going to be a pretty big job to squeeze out of the Government higher official prices for sulphate. The after-war position also needs careful consideration, as the production of synthetic ammonia, already foreshadowed, both here and in America, must have some serious effect upon present makers of sulphate, unless steps are taken now to safeguard interests. And one cannot hear that any such steps are being taken. Some of the Scotch oil companies, however, who depend a great deal upon their production of sulphate, are considerably disturbed, and are following the developments of synthetic production very closely.

The General Purposes Committee of the Wandsworth Borough Council indicate several points in regard to which they think the Council should oppose the Wandsworth, Wimbledon, and Epsom District Gas Bill.

The Gas Light and Coke Company have intimated to the Westminster City Council that, after the current quarter, the price of gas supplied to street-lamps, except in cases where a fixed annual charge is made under contract, is to be increased from 3s. 1d. to 3s. 7d. per 1000 c.ft.

Monometer Manufacturing Company.—Notice has been filed of the appointment, in connection with the Monometer Manufacturing Company, Ltd., of Birmingham, of Mr. H. T. E. S. Ledsam, of No. 16, Waterloo Street, Birmingham, and Mr. W. E. Withnall, of No. 19, Temple Street, Birmingham, as Receivers of the property comprised in a first mortgage debenture for £10,000, dated Aug. 1 last.

Lighting of Calcutta.—The yearly administrative review of the Calcutta Municipal Council states that the Council recognize the improvement in the lighting of the city during recent years; but they are of opinion that, before extravagant lighting schemes are brought into operation in any part of the city—such as dual or double-row lighting arrangements on the same road—gas-lamps should be provided in those parts of the city which are still so poorly lighted with oil-lamps.

Gas Explosion at Bolton.—A gas explosion occurred last Wednesday in a house in Bolton which had been unoccupied for over three months. On a visit being paid to the premises, the chandelier was observed to be loose. The gas was lighted; but when an attempt was made to secure the chandelier, an explosion occurred. A nephew of the owner of the property was burned about the hands and face; and his wife and sister were injured. Considerable damage was done to the house.

Fire at the Aldershot Gas-Works.—A fire broke out on Thursday night in the engine-room of the oil-gas plant at the Aldershot Gas-Works, in the Ash Road, but was fortunately taken in hand by the Company's own firemen in time to prevent a serious conflagration, as there was a considerable quantity of oil in tanks not far from the spot where the fire originated. Within a short time the Aldershot brigade were playing on the fire in conjunction with the gas-works brigade. The fire was got under control without serious damage being done to the plant; and owing to the excellent efforts of the Company's employees, gas making was resumed in a few hours. The roof and other parts of the building suffered. The cause of the outbreak is unknown, and is under investigation.

Correction by the Chairman of the Carlisle Gas Committee.—Writing to the "Carlisle Journal" with reference to his speech in the City Council, reported on pp. 166-7 of last week's "JOURNAL," Mr. J. P. Buck (the Chairman of the Gas Committee) says: I mentioned that Mr. Hutchinson, before he came to Carlisle, had completed a very successful installation at Workington for the carbonization of coal. This I quite understood at the time was a fact; but I have been since informed that, beyond the installation of purifiers and holder, he had nothing to do with the carbonization plant—except, perhaps, the decision as to the particular system to be adopted was arrived at before he left Workington. I now understand that the whole of the carbonization plant was ordered, erected, and started under the direct supervision of the Gas Engineer to the Borough of Workington (Mr. Horace Chamberlain, A.M.I.Mech.E.), who should most certainly receive the credit for it. I am exceedingly sorry if, under an entire misapprehension, I have done any injustice to Mr. Chamberlain.

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Price of Gas in Glasgow.—The Glasgow Corporation Gas Committee agreed to recommend that the price of gas be increased 4d. per 1000 c.ft. This will raise the rate for gas supplied within the city supply district, for lighting and domestic purposes in quantities up to 500,000 c.ft., to 3s. 4d. Throughout last year the charge was 2s. 6d.; but owing to the increased cost of production, the rate was raised at the beginning of the present financial year, on June 1, 1917, to 2s. 8d. To this, 4d. was added in November last.

Halifax Wages Award.—The Committee on Production have awarded to the Halifax Corporation workmen aged 18 and over 16s. per full ordinary week over pre-war rates, in the case of day workers, and 2s. 8d. per shift in the case of shift workers. Increases have also been given to women in certain departments, but not including the gas department. The award is equivalent to a 4s. advance on existing rates. The demand of the Workers' Union was for an increase on pre-war rates of 20s., and an additional bonus of 12½ p.ct.

Quality of the Brighton Gas Supply.—Referring to the proceedings of the Improvement Committee, at a meeting of the Brighton Town Council, Mr. Tindall criticized the quality of the gas; and the Town Clerk remarked that the question of pressure was being gone into. The Council approved a contribution on the basis of rateable value (the amount not in the first instance to exceed £50) towards the expenses of opposing proposals of gas companies seeking, among other things, to have a heating standard substituted for a lighting standard.

Batley Gas-Workers' Petition for Meat.—The meat shortage has been such in Batley that last week the men at the Corporation gas-works, supported by a letter from Mr. Arthur Bromley (the Manager), petitioned the local Food Committee to do something to equalize meat distribution in the town. The men said most of them had had no meat for a fortnight; and it was impossible to do their heavy work as they ought to do it without proper food. Mr. Bromley's letter hinted at a possibility of the gas workers threatening to "down tools," if they do not get better supplies, as they were very sore on the matter. The Food Committee decided to do their best.

Woman Killed by Gas Department Car.—An inquest was held last Thursday, by the Manchester Coroner (Mr. W. Sellers), relative to the death of Emily Hamilton (aged 75), who was knocked down by a car belonging to the Manchester Corporation Gas Department, and driven by a young woman who had only been licensed twelve weeks. The driver said she thought, when the deceased stepped off the footpath, she was waiting for the car to pass, but she walked on in front of it. In advising the Jury to return a verdict of "Accidental death," the Coroner remarked that he could not help thinking that, had the driver of the car had greater experience, the accident would not have happened.

The Rawmarsh Gas-Works Explosion.—The fatal explosion in an engine-house at the Rawmarsh Gas-Works formed the subject of an inquiry last Thursday, when the Coroner said he thought they would find it impossible to ascertain with certainty what was the origin of the occurrence. The Manager (Mr. E. O. Watson), who said he had been at the works 28 years, gave it as his opinion that there had been a stoppage in the gas-main, and extra pressure on the main unsealed the seal in the cellar of the engine-house. This would fill the cellar with gas, which might become ignited in the engine-house or the retort-house. The Jury accepted the explanation given by Mr. Watson, and returned a verdict of "Accidental death" in the case of the workman who was killed.

Metal Rationing for Burners and Fittings.—A letter is being sent out to the manufacturers of gas burners and fittings by Mr. F. J. Gould, the Managing-Director of the Bland Light Syndicate, Ltd., in his capacity as Chairman of Section VII. of the Society of British Gas Industries, pointing out that, at the request of the Ministry of Munitions, the Society are acting as the rationing body for the whole of the metal for the production of burners and fittings required by the manufacturers. Those requiring material for the production of these goods, for either industrial or domestic purposes, are requested to send to Messrs. Price, Waterhouse, & Co., No. 3, Frederick's Place, London, E.C., a tabulated list of their purchases of metal from Aug. 1, 1915, to July 31, 1916.

Oswaldtwistle Gas Supply.—At the monthly meeting of the Oswaldtwistle District Council, Mr. T. C. Usher (the Chairman of the Gas Committee) alluded to letters he had received, and complaints made to him personally, with regard to the luminosity of the gas. He assured the public that no complaint could be urged against Mr. J. H. Davies (the Gas Engineer); and the people who had written to him ought to know, and have regard to, the exceptional circumstances. In view of the heavy demand made by the Government upon gas undertakings, it was really astonishing to him, as Chairman of the Gas Committee, that the Manager had kept up to the times so well as he had, and that there were not a far greater number of complaints. He must, he said, congratulate Mr. Davies on the manner in which he had kept his end up; and he appealed to the public to be a little more tolerant.

Bingley Gas Shortage.—At last week's meeting of the Bingley District Council, at which the Gas Committee's action in cutting off the supply from 10 o'clock every night until it is possible to give a full supply was approved, Mr. Turner, the Chairman of the Committee, said the two principal causes of the position were the unsatisfactory supply of coal (which the Committee had been endeavouring to remedy) and the larger consumption of gas than during the corresponding period of the previous year. Since the beginning of 1918 there had been an average excess consumption of 20,000 c.ft. per day. The fault was not with the output, as more gas had been produced than in the same period last year. The nightly cutting off at 10 o'clock would only occur when necessary; but the public must put up with the inconvenience rather than let the industries suffer from lack of supply. The Committee thought they were now about on top of the difficulty.

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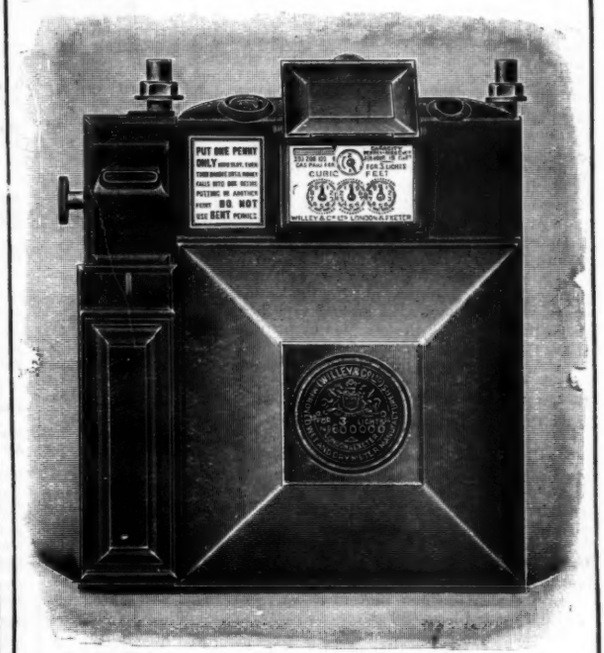

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Accident at the Salford Gas-Works.—A singular accident occurred at the Salford Gas-Works last Thursday morning, causing severe injuries to a labourer employed by the department. The man was unloading coal, when the back of the cart dropped on him. He was conveyed to the infirmary in a serious condition.

Gas Poisoning Fatalities at Belfast.—Three deaths from gas poisoning were lately reported in Belfast. Mr. Andrew Patterson, aged 80, a retired teacher, who resided alone in the Lisburn Road, was found dead seated on a chair in one of the rooms; the place being filled with gas. Mr. John J. Gibbons, licensed vintner, of Hanover Street, remained over-night in his shop, owing to a difficulty in closing one of the doors, and in the morning was found lying on the floor in an unconscious condition; the place being filled with gas fumes. It was discovered that a pipe connected with a stove had been broken, thus causing a leakage. The victim was removed to hospital, but died from the effects of gas poisoning. The third case was that of Mrs. Elizabeth Maguire, of Leopold Street, who succumbed to the effects of gas fumes in her bedroom. The gas was not used for lighting purposes; but there was a short pipe projecting from the wall, and it is thought that, in hanging some clothes near it, the tap was accidentally turned on. Verdicts of "Accidental death" were returned at all the inquests.

Coal Shortage Causes Failure of Gas Supply.—Gosberton, a small town in Lincolnshire, has been without gas; it having been found necessary to close-down the works through shortage of coal.

The Skipton Urban District Council have granted an advance of 1s. 8d. per week to labourers at the gas-works, with time-and-a-quarter rates for weekday overtime and time-and-a-half for Sunday overtime. Fitters and mechanics are granted 2s. 6d. per week advance; and six stokers are given an advance of 6d. per shift.

As a matter of urgency, the Electricity Committee of the Willesden Urban District Council decided to accede to a request made in a letter from the Gas Light and Coke Company, who pointed out the difficulty experienced by them in maintaining an adequate supply of gas to munition factories in the Park Royal area, owing to the small diameter of the supply main in Acton Lane. The Company asked permission to instal a motor-driven fan at the Council's sub-station in Acton Lane in connection with the supply main, and agreed to accept reasonable conditions with respect to rent and notice to remove the plant. The motor will not exceed 1 H.P.; and the floor space occupied will be approximately 3 ft. by 4 ft. The consent is subject to a formal agreement being entered into, and to the payment of a rent of 30s. per month.

STOCK MARKET REPORT.

THE Stock Exchange has had another very quiet week, humdrum and uninteresting, and, beyond this, it is difficult to find any epithet to characterize it. Hardly a line could be found with a spark of animation in it, and markets generally drooped for lack of support. But, happily, before the close there was some indication of improvement in tone, although business failed to quicken up.

The gilt-edged division was not similarly affected throughout. Home Government issues had a decidedly easier tendency. War Loans of all issues and Consols weakened, though they steadied somewhat just before the close. Colonials and Indian were in some request. Home Rails took a better line. Buyers were quite ready to take more stock if it were to be had, in pleasing anticipation of dividend announcements. Canadians moved irregularly; but Argentines were pretty firm, although the strike position does not seem quite clear. South African did fairly well.

The Foreign Market was somewhat mixed. French loans oscillated; but the final move was upward. Russians were at first very bad; but even they were a little less gloomy at the close. Brazilians moved this way and that, in obedience to Exchange dictation. The Miscellaneous Market was mostly dull and uninteresting. Oil was fairly firm; but Rubber was quite out of favour. Iron and Steel and Munitions had their supporters; but Shipping was easier, and even Breweries stayed their progress.

Business in the Gas Market showed no falling-off in point of volume, and it was pretty evenly shared by a number of undertakings of every category, and not crowded into two or three of the big issues. The general tone was quite steady; all the prices of a week ago being fully maintained. An incident of unusual occurrence was the fact that there was not any change made in quotations.

In the Money Market, rates ruled easy for awhile, but the tendency gradually hardened.

Bargains done for cash during the week were as follows: On Monday, Bournemouth preference 9⅜, Brentford "B" 76, Cape Town 60s. 7½d., Commercial 4 p.ct. 71, European 10⅜, Gas Light ordinary 70¼, 70¾, 71, Imperial Continental 89, 89½, 90, Primitiva 35s., 36s. 3d., ditto preference 56s. 3d., ditto debenture (1911) 58, San Paulo debenture 40¼, 43, South Suburban debenture 84½, Southampton 76½. On Tuesday, Bombay 5⅞, Brentford "A" 79, ditto debenture 67, Commercial 3½ p.ct. 65, European 10, 10¼, Gas Light ordinary 70, ditto maximum 57½, ditto preference 70½, 71, Imperial Continental 89½, Primitiva 35s. 6d., 36s., ditto preference 56s. 3d., Sheffield "C" 182, South Metropolitan 75½, 75¾, South Suburban 76, Metropolitan of Melbourne 8¼, 8 5/16. On Wednesday, Brighton and Hove original 149, Gas Light ordinary 70, 71, Ilford "A" and "C" 92½, Imperial Continental 89½, 89⅞, 90, Primitiva 36s., South Metropolitan 75¾, ditto preference 93¾. On Thursday, Gas Light ordinary 70½, 70¾, 71, ditto preference 71½, Primitiva 35s., 36s. 3d., South Metropolitan 75¾, 76, 76¼, 76½. On Friday, Brentford "A" 80, Commercial 4 p.ct. 70½, Brighton and Hove original 149, Continental Union preference 61½, Gas Light ordinary 71, ditto preference 71⅛, 71¼, Hastings 51, Imperial Continental 90, ditto debenture 66, 66¼, South Suburban 76½.

The Bank rate is 5 p.ct., as fixed on April 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	57—62	..
1,551,868	,,	April 8	2½	4⅛%	Alliance & Dublin Ord.	59—64	52—57	..
874,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	53—63*	..
280,000	5	April 29	7½	3/6	Bombay, Ltd.	5⅞—6⅜	5—5½	5 5/16
50,000	10	Feb. 26	16	14%	Bournemouth Gas { 10 p.c.	29—30	23—25	..
388,110	10	,,	7	7%	B 7 p.c.	15—15½	10½—11	..
115,000	10	,,	6	6/-	and Water { Pref. 6 p.c.	13½—14	9—9½	9⅜
159,740	—	—	—	4%	4 p.c. Deb.	..	67—69	..
922,045	Stk.	Feb. 26	14	5½%	Brentford A Consolid.	261—266	79—82	79—80
734,930	,,	,,	11	4⅛%	Do. B New	204—209	76—79	76
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	81—86	..
291,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—93	63—65	67
217,380	,,	Feb. 26	11	10%	Brighton & Hove Orig.	208—213	145—150	149
244,200	,,	,,	8	7%	Do. A Ord. Stk.	154—159	98—103	..
530,000	20	Mar. 26	12½	22/6	British	44—45	32—33	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	66—68	..
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	51—54	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	3—3½	60/7½
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,518,280	,,	Feb. 12	5/9/4	41/-	Commercial 4 p.c. Stk.	106—108	70—72	70½—71
560,000	,,	,,	5¼	40/-	Do. 3½ p.c. do.	103—105	64—66	65
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	39—41	..
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	61—63	61½
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	165—175	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—125	95—100	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	10—11	10—10½
16 298 975	Stk.	Feb. 10	4/17/4	37/4	4 p.c. Ord.	93—102	69—71	70—71
2,600,000	,,	,,	3½	3½%	Gas Light { 3½ p.c. max.	76—79	56—58	57½
4,062,235	,,	,,	4	4%	and { 4 p.c. Con. Pref.	96—99	70—72	70½—71½
4,674,850	,,	June 11	3	3%	Coke { 3 p.c. Con. Deb.	72½—74½	55—57	..
130,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
258,740	,,	Mar. 12	5	3½%	Hastings & St. L. 3½ p.c.	87—89	48—53	51
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅝	7½—8½	..
86,600	—	—	—	9%	Hornsey 7 p.c.	..	115—125	..
131,000	Stk.	Mar. 12	7⅛	7%	Ilford A and C.	151—154	92—97	92½
65,780	,,	,,	6⅛	5½%	Do. B	115—118	72—77	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	63—66	..
4,940,000	,,	May 14	9	4½%	Imperial Continental	150—160	88—91	89—90
1,235,000	,,	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	66—66½
285,242	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	82—87	..
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A / B	211—213 / 146—148	82—84	..
306,088	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—73	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅜	3⅜—3⅝	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	89—100	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8—8½	..
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	98½—99½	76—77	..
529,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	60—62	..
55,940	10	Feb. 26	7/14/0	7%	North Middlesex 7 p.c.	14—15	9½—10½	..
900,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	102—104	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅜—7⅝	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	125—131	83—88	..
100,000	50	,,	12	11%	Do. C	118—121	73—78	..
52,000	50	,,	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅜—6	1⅜—2	35/—36/3
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅜—5	2¾—3	56/3
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	76—78	..
—	—	—	—	4%	Do. ,, ,, 1911	..	..	58
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	57—62	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10⅝—11	7⅜—8	..
125,000	50	July 1	5	5%	{ 5 p.c. Deb.	4⅞—49	40—42	40¼—43
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—294	..	..
209,984	,,	,,	10	10%	Do. B	222—224	180-184	..
523,500	,,	,,	10	10%	Do. C	220—222		182
90,000	10	May 28	9	6/-	South African	10½—11½	9—10	..
6,609,895	Stk.	Feb. 10	5/4/0	46/8	South Met. 4 p.c. Ord.	111—113	75—77	75½—76½
—	—	—	—	—	Do. Pref.	..	92—94*	93¾
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	54—56*	..
224,820	,,	Feb. 26	8½	7½%	South Shields Con. Stk.	157—159	127—129	..
962,795	,,	,,	6	4⅝%	S'th Suburb'n Ord. 5 p.c.	114—116	75—77	76—76½
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	75—77	..
135,000	,,	,,	—	4⅝%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	84—86	84½
647,740	,,	May 14	5	5%	Southampton Ord.	99—102	75—77	76½
120,000	,,	Feb. 12	7½	5½%	Tottenham { A 5 p.c.	135—138	99—97	..
782,275	,,	,,	6	4⅜%	District { B 3½ p.c.	115—117	70—72	..
181,255	,,	June 26	4	4%	{ 4 p.c. Deb.	87—89	61—63	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	103½—109½	89—91	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Feb. 26	8⅜	72/6	Wandsworth A 5 p.c.	151—156	112—117	..
255,636	,,	,,	6⅞	57/6	Do. B 3½ p.c.	129—134	97—99	..
108,075	,,	,,	5/17/3	50/9	Do. C 3⅜ p.c.	110—115	84—89	..
352,900	,,	,,	6⅛	51/3	Wimbledon 5 p.c.	117—122	85—90	..
98,000	,,	,,	6⅞	57/6	Epsom 5 p.c.	121—126	93—98	..
88,416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	49—52	..

* Ex Div.